BULLETIN OF THE HISTORY OF MEDICINE

ORGAN OF THE AMERICAN ASSOCIATION OF THE HISTORY OF MEDICINE
AND THE JOHNS HOPKINS INSTITUTE OF THE HISTORY OF MEDICINE

Editor—HENRY E. SIGERIST

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PREFACE TO VOLUME VII

The *Bulletin of the History of Medicine* is entering the third period of its life. When Dr. Welch made plans for the creation of an Institute of the History of Medicine he considered the publication of such a journal from the very beginning. The Bulletin could not be launched, however, before the Institute was fully organized and staffed and its research work well under way. We began very cautiously by publishing the journal as a Supplement to the *Johns Hopkins Hospital Bulletin*. We did not know at the time how much space the publications of the Institute would require, nor did we know how much demand there was outside the Institute for a new journal of medical history. And, in addition, we were at the bottom of the depression when it would have been impossible to find subscribers for a new independent journal. Our work would have remained unnoticed while it reached almost a thousand readers by being published as supplement to the *Johns Hopkins Hospital Bulletin*.

The first volume issued in 1933 (480 pages, 16 plates, 32 illustrations) contained papers written by members of the Institute staff, by members of the Hopkins Faculty at large and papers that had been read at meetings of the Johns Hopkins Medical History Club.

The reception of this first volume was extremely encouraging. We realized that there definitely was a need for a scholarly journal of medical history and in the second volume, in 1934, we published a number of papers written by scholars who had no connection with

our University. The size of the journal was increased to 628 pages with 15 plates and 41 illustrations.

But now the time had come to disconnect the ties with the *Johns Hopkins Hospital Bulletin*. We knew that we were losing many readers, but the cost of production had increased so considerably that we could no longer afford to give the Bulletin away without any charge but had to seek for some revenue.

With Volume III, in 1935, the Bulletin entered the second period of its life as an independent periodical publishing ten numbers a year. During the four vacation months only two numbers are issued as we know by experience that vacation numbers are easily overlooked. The journal still appeared as the *Bulletin of the Institute of the History of Medicine*, being published and financed by the Institute, but it was now open to all serious workers in the field.

Although many manuscripts submitted to the editor could not be accepted, the Bulletin grew in size and content from year to year. It had 772 pages in 1935, 857 in 1936, 946 in 1937, and over 1000 pages in 1938, which proved that there was a need for such a journal. The number of subscribers, although not large, increased steadily and the Bulletin was found in almost all medical libraries.

The *American Association of the History of Medicine* at its Annual Meeting held in Atlantic City, on May 2, 1938, adopted a new Constitution which in Article 17 provides that " the Association may publish its transactions independently or with an established journal."

In October 1938, the Council of the Association decided to make this journal the organ of the Association. It was felt that such an agreement should benefit both partners. The Association will be able to publish its transactions in a recognized periodical without financial risk and the Bulletin will increase its circulation by being sent to all members of the Association (Constituent Societies, active and honorary members). The dues to the Association had to be raised from $1.50 to $5.00 (four of which are turned over to the Institute as subscription to the Bulletin). This may seem hard to some members but we think that whoever joins the Association will appreciate the contents of the Bulletin which moreover will create a strong bond between the members and keep them informed

about medico-historical activities in this country and abroad. Even when dues are very low it is difficult for a society to hold its members unless it has a publication to keep the interest alive throughout the year.

The Bulletin will remain the property of the Institute and will continue to be edited by its director who will retain full responsibility for the journal. The editor, however, being at the same time an officer of the Association will work in close cooperation with the Council and will be glad to consider suggestions from the membership.

Every year the Bulletin will publish the annual report, minutes and announcements of the Association and the annual reports of all the Constituent Societies. It will also publish the Fielding H. Garrison Lecture and those papers read at the Annual Meeting or other meetings that are found worthy of publication.

Otherwise the general policy will remain unchanged. As heretofore we shall endeavor to make the Bulletin a scholarly publication which does not mean that it must be dull. True scholarship is never dull. The most complicated subject can be presented in a lucid way and whoever thinks clearly is able to present his case with clarity. But we require that papers submitted for publication be original, that they contain new facts, new ideas, or new presentations or interpretations of known facts. Our primary purpose is to advance research in medical history.

As we did in the past we shall lay strong emphasis on the publication of *Texts and Documents*. Every historical discipline must make new sources available and this is particularly necessary for a young subject like ours where so many important sources are still buried in libraries and archives. We shall also continue to reprint some classical texts of medicine and to make them available in reprints, bound in boards, at a price that just covers the cost of production. So far we have published:

Tobias Smollett, An Essay on the External Use of Water, edited by Claude E. Jones, 1935, 54 pages, frontispiece, 4to, $1.00.

Leopold Auenbrugger, On Percussion of the Chest, translated by John Forbes. Introduction by Henry E. Sigerist, 1936, 32 pages, frontispiece, 4to, $0.75.

Albrecht von Haller, A Dissertation on the Sensible and Irritable Parts of Animals, 1755. Introduction by Owsei Temkin, 1936, 49 pages, frontispiece, 4to, $1.00.

Paul Langerhans, Contributions to the Microscopic Anatomy of the Pancreas, Reprinted from the German original with an English Translation and an Introductory Essay by H. Morrison, 1937, 39 pages, 4to, $1.00.

Hermann von Helmholtz, On Thought in Medicine. Introduction by Arno B. Luckhardt, 1938, 27 pages, frontispiece, 4to, $0.75.

Ivar Sandström, On a New Gland in Man and Several Mammals (Glandulæ Parathyreoideæ). Translated by Carl M. Seipel, edited by Charlotte H. Peters and J. F. Fulton, with biographical notes by Professor J. August Hammar, 1938, 44 pages, frontispiece, 4to, $0.75.

Jacob Henle, On Miasmata and Contagia. Translated by George Rosen, 1938, 78 pages, frontispiece, 4to, $1.00.

We feel that this does not interfere in any way with the splendid publication of Dr. Emerson Crosby Kelly, *Medical Classics*[1] as the principle of selection is different. On the contrary, the two publications complete each other in the best possible way. We shall also continue to issue special reprints of bibliographies like that of W. R. LeFanu of *British Periodicals of Medicine*.[2] Such bibliographies are extremely valuable to scholars and librarians. It would be very difficult to publish them as separate books but we think that they should be available outside the Bulletin and should have a place on the shelf of reference books of every medical librarian.

The section *Notes and Comments* will continue to bring short notes on various subjects of medical history and comments on important new publications or movements. I am not quite clear in my mind yet how we shall handle the problem of book reviews. So far the Bulletin has not accepted any books for review and has published only surveys of new publications covering a definite field.[3] We already have two journals that include the bibliography of medical history fairly completely: *Isis* and the German *Mitteilungen zur*

[1] *Medical Classics*, compiled by Emerson Crosby Kelley. Published monthly except July and August, Williams & Wilkins Co., Baltimore, Md.

[2] W. R. LeFanu, *British Periodicals of Medicine, A Chronological List*. The Johns Hopkins Press, Baltimore, 1938.

[3] H. E. Sigerist, *On Hippocrates*, 1934, Vol. II, pp. 190-214; O. Temkin, *Recent Publications on Egyptian and Babylonian Medicine*, 1936, Vol. IV, pp. 247-256, 341-347.

Geschichte der Medizin, Naturwissenschaft und Technik. On the other hand I understand that the members of the Association would like to be informed about important new publications in the field. A short review of a book written by a man who has not taken the trouble to read it and has no expert knowledge of the subject is worthless. A good review offers constructive criticism and a definite contribution to the advancement of research. But it is difficult to find experts who have the time for reviewing books and much space is required to cover the field, more than this Bulletin could provide.

We are therefore, as a matter of experiment, going to take a middle course in this volume by reviewing some books that for some reason or other seem important to us and for which we can find suitable reviewers. This policy will be reconsidered at the end of the year and suggestions from the membership will be appreciated.

In the section *Contemporary History* we shall continue to publish from time to time papers dealing with general contemporary subjects which may become material for the historian of the future. In this section the editor of the Bulletin intends to publish a report on his last trip through the Soviet Union and a critical analysis of the so-called " Neo-Hippocratic " movement.

And finally we shall endeavor to build up the section *Medico-Historical News and Activities* so that the members of the Association will be kept informed about developments in this country as well as abroad. We would greatly appreciate it if those colleagues who are teaching medical history in the United States and Canada would send us their lecture announcements and if the delegates of the Constituent Societies would put us on their mailing lists so that we would receive their programs regularly. We are anxious to have as complete as possible archives of all medico-historical activities in this country and Canada.

I wish to end by saying that no effort will be spared to raise the standard of the Bulletin and to make it worthy of the American Association of the History of Medicine.

HENRY E. SIGERIST

MEDICAL LOGIC

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We should, any one of us, be indignant at the suggestion that reasoning is not a part of the process that we adopt in our observation and correlation of the facts furnished by nature. Still more is reasoning needed in planning experiments that provoke new facts. There is, indeed, nothing in the history of experimental medicine that does not involve thought, reasoning, and even speculation. And yet the suspicion of modern scientists is at once aroused, if not by the term " logic," at least by the word " speculation," since both are tarred by the brush of that allegedly sterile field known as metaphysics, which, in appearance, is the antithesis of productive experimental science. Logic is, indeed, not merely a subdivision of philosophical reasoning; it is the very science of reasoning. And we may not assume that we reason logically without a certain apprenticeship in the history of philosophical thought.

Moreover, according to Bowne,[1] " the sole aim of *speculation* is to find out the causes of phenomena " and certainly the latter quest is the purpose of science. " The trouble is that *to speculate* has come to mean of late, through a disease affecting many a good word, *to speculate* badly " (Southard).[2] If we were to use the word " hypothesis," instead of " speculation," it would be greeted with enthusiasm by the experimentalist, although Francis Bacon,[3] the patron saint of modern science, failed to utilize this most useful of all experimental methods. Bacon's mistake lay in the fact that he was a theorist in experimentation, a believer merely in his newer approach in obtaining knowledge, and he never became a practitioner of the method he advocated.

[1] Bowne, Borden P., Metaphysics, a Study in First Principles, New York, Harpers, 1882, p. 286.

[2] Quoted from random unpublished notes of Dr. E. E. Southard, late Professor of Neuropathology in Harvard University, in possession of the author.

[3] Article on Sir Francis Bacon by Robert Adamson and John Malcomb Mitchell in The Encyclopedia Brittanica, 11th edition, 1910.

It is difficult today to realize how abrupt the transition from pure reasoning to experimentation is. "Man is by nature metaphysical and proud," says Claude Bernard.[4] Although it may be easier for an Anglo-Saxon to accomplish this feat, since he is by nature geared for action rather than contemplation, yet:

There is a strange prejudice, asserts Bacon,[5] "that the dignity of the human mind is lowered by long and frequent intercourse with experiments and particulars,—especially since such matters generally require labor in investigation, are mean subjects for meditation, harsh in discourse, unpredictive in practice, infinite in number, and delicate in their subtlety."

It seems amazing that a contemporary of Descartes, William Gilbert, van Helmont, Galileo, Kepler, and Harvey should have made little or no reference to the fundamental scientific discoveries of these men. Harvey, indeed, was Bacon's personal physician, and his remark to Aubrey about the great philosopher may explain the divergence in their point of view. "The Lord Chancellor," said Harvey,[6] "writes philosophy . . . like a Lord Chancellor."

As Professor Sanford[7] has recently pointed out, Francis Bacon was an amateur in experimentation when compared with his namesake, Friar Roger Bacon, who lived three hundred and fifty years before him. And Roger Bacon developed certain of the ideas for which Francis Bacon is most extolled, namely, the rejection of authority, of prejudice, and of pure reason in favor of experience and experiment. The quality of Roger Bacon's thought is exemplified by a quotation[8] from his "Opus Majus":

For there are two modes of acquiring knowledge, by reasoning, and by experience. Reasoning draws a conclusion, and makes us grant the con-

[4] Claude Bernard, "Introduction à l'Étude de la médecine expérimentale," Paris, Ballière, 1865. The citations given are from the English translation "An Introduction to the Study of Experimental Medicine," by Henry Copley Green, with an introduction by Lawrence J. Henderson. New York, The Macmillan Co., 1927.

[5] "The Physical and Metaphysical Works of Lord Bacon," by Joseph Devey, London, G. Bell and Co., Ltd., 1911, p. 417.

[6] Quoted by Locy, W. A., Growth of Biology, New York, Holt, 1925, p. 181. By "philosophy" is meant of course natural philosophy, or "science."

[7] Sanford, Fernando, Francis and Roger Bacon and Modern Science, *Scientific Monthly*, 1937, V, 44, p. 440.

[8] Quoted by Sanford above.

clusion, but does not make the conclusion certain, nor does it remove doubt so that the mind discovers it by the path of experience. . . . Aristotle's statement, then, that proof is reasoning that causes us to know, is to be understood with the proviso that the proof is accompanied by its appropriate experience and is not to be understood as the bare proof. Reasoning does not suffice but experience does. . . . He therefore who wishes to rejoice without doubt in regard to the truth's underlying phenomena must know how to devote himself to experiment.

But of course Friar Bacon did not invent experimentation, an idea that goes back, in the particular field to which I am drawing attention, at least to Galen. And although the earlier Bacon and all the contemporaries of Francis to whom I have referred followed a similar method of scientific thinking, and incidentally outlined it, Francis Bacon first formulated, in his *Instauratio*, or reorganization of learning, and in the *Novum Organum*,[9] a suitable logic for the interpretation of nature. Bacon's methodology of science may, if you like, be scorned as the program of a promoter rather than of a producer; but unlike the organization charts of most politicians Bacon's ideas were destined to influence the progress of science for the next three hundred years.

How in a few words may we review the hundred and more axioms through the application of which Bacon would guide us in interpreting nature? In the first place, "Our present sciences," he says,[10] "are nothing more than peculiar arrangements of matters already discovered, and not methods for discovery or plans for new operations." We must not blindly accept ancient philosophies; we must lay aside in our thinking our natural prejudices—in other words, Bacon's famous "Idols," [11] whether they come from common modes of thought (Idols of the Tribe), from individual thinking (Idols of the Cave), from influence of the spoken word (Idols of the Market Place), or from tradition (Idols of the Theatre). For all such bases of belief Bacon would substitute Experience and Observation. And Bacon understood "experience" in the larger sense, in the happy inclusive sense of the French "expérience," not only as experience that comes haphazardly by the whim of chance but as

[9] Bacon, F., *loc. cit.*, 5.
[10] Bacon, F., *loc. cit.*, Aphorism VIII.
[11] Bacon, F., *loc. cit.*, Aphorisms XXXIX-XLIV.

that form of experience that is deliberately sought, whose flow may be accelerated, and the sequence of whose consecutive phenomena may to an extent be directed—in other words, that form of experience we now call " experiment." The art of indication or direction in scientific progress proceeds either from experiment to experiment, " the chase of Pan " as Bacon calls it, or from experiment to the formulation of " notions," by which he meant a concept or hypothesis, which latter may in turn engender further experiments.

The analysis of experience is logic, and in Bacon's hands it became logic of a new sort. The older Aristotelian logic is a prioristic, or intuitive; it is embalmed in the syllogism and calculates deductively from the apparent nature of the case without reference to actual experience; it strives for dialectic victories and the discovery of new arguments. Bacon's *inductive* logic, an a posteriori form of reasoning, can be constructed only with the aid of deliberately provoked observations of *similar events*, rather than from a comparison by analogy of phenomena that may turn out to be wholly dissimilar.

Bacon started, then, a new and connected method of thinking and planning in science. He urged a revision of science; he discouraged rash generalization in interpretation and favored the critical analysis of experience. Great experimenters had already appeared but here for the first time were stated the *precepts* of experimentation.

It may seem surprising that, in view of the impetus that Bacon gave to experimentation and reasoning, it should have required two hundred and fifty years for medical science to reach the stage of satisfactory philosophical formulation of its problems. I am taking as a landmark of this stage the publication in 1865 of Claude Bernard's [12] " Introduction à l'étude de la médecine expérimentale." The explanation of this delay is, however, simple enough in view of the great complexity of living cells as contrasted with the physical and chemical units of which they are composed. Whatever our reaction to the term " vitalism " may be, there is no question of the greater difficulty in explaining an organized living cell as something more than the chemistry of proteins. Little surprise then that the mere technique of studying life processes should lag—percussion

[12] Bernard, C., *loc. cit.*

was not introduced into medicine, by Auenbrugger,[15] until 1761, and Laennec [16] did not publish his "L'auscultation médiate" until 1819. The first direct information about digestion by Beaumont [16] was obtained in 1822 and not published until 1833. Abiogenesis was finally disposed of by Pasteur [16] as recently as 1866.

In other words, the harvest of experience in medicine was delayed, in common with, and beyond, that of other life sciences, until methods and techniques were developed. But meanwhile speculation, and, thanks to Bacon, speculation of a better and more inductive sort, a provocative medical logic, became rife a hundred years ago. It was no longer the type of speculation that translated the four supposititious elements into four corresponding humors and explained disease forthwith on the basis of wrong admixtures of these humors, but speculation in closer touch with reality.

But we have not reached as yet in our survey of medical reasoning the era of a hundred years ago. So far as the history of medicine is concerned the seventeenth century, Bacon's own era, was, according to Garrison,[17] a period of "Individual scientific endeavour"; that is to say, great scientific discoveries were being made. We are not concerned here with enumerating these discoveries but only with the explanatory theories to which they gave rise. They may be briefly summarized as first, "Iatromechanical," following the formulations of Descartes and Harvey in geometry and in physiology; and secondly, "Iatrochemical," following the chemotherapeutic empiricism of Paracelsus, whose follower in the century to which we refer was van Helmont with his concept of ferments and gases.

[15] Auenbrugger, Leopold, Inventum novum ex percussione thoracis humani. Vindobonae, J. T. Trattuer, 1761.

[16] Laennec, Réné -T.-H., De l'ausculation médiate, Paris, Brosson et Chaudet, 1819. 2 vols.

[16] Beaumont, William, Experiments and observations on the gastric juice, and the physiology of digestion. Plattsburgh, F. P. Allen, 1833.

[16] Pasteur's work on "So-called Spontaneous Generation" was accomplished between the years 1860-1866 and was published in seventeen articles which may be found in Tome II of the collected Œuvres de Pasteur by Valley Radot, Paris, Masson et Cie, 1922, pp. 185-320.

[17] Garrison, Fielding H., An Introduction to the History of Medicine, 4th ed., Philadelphia, W. B. Saunders, 1929.

The eighteenth century was philosophically more embracing but less factual; the age of "Theories and Systems," Garrison[18] calls it. It included the Linnean classification, animism, vitalism, the systematists with their statistical methods, and the eclectic school. The last group pursued the only line of thought that was completely sterile. Boerhaave, its protagonist, not only performed no experiments but, according to Allbutt,[19] "contented himself with hashing up the partial truths and the entire errors of his time."

And so the seeds of a more generalized inductive reasoning sowed by Bacon remained largely dormant throughout this period of two hundred years. Experimentation, which he applauded in principle, had been cultivated vigorously in the seventeenth century, but less actively in the eighteenth. The logic that formed the basis of the transitory medical theories remained largely deductive or a prioristic.

Although I lay no claim to historical completeness it would seem that William Hillary,[20] in 1761, in his "Inquiry into the means of improving medical knowledge . . . ," first appreciated the guiding value of the Baconian method of arriving at truth. But "Medical Logic" in title and in fact is more particularly the philosophical accompaniment of the "Modern Era in Medicine," which was ushered in with the nineteenth century. Medicine, more slowly than other sciences, had passed through the first two stages in the acquisition of knowledge outlined by Comte,[21] namely, the theological and the metaphysical. It was facing the third stage of sober but positive science. It is surprising to learn of the several extended treatises and the numerous essays, theses, and addresses that reflected the need for better reasoning about disease during the first half of the last century. In fact, medical logic became an integral part, as we shall see, of medical education, which apart from apprenticeship was largely didactic during this period.

[18] Garrison, F. H., *loc. cit.*

[19] Allbutt, Sir Thomas Clifford, "Medicine in 1800." *Brit. Med. Jour.*, 1900, *2*: 1850.

[20] Hillary, William, An Inquiry into the means of improving medical knowledge by examining all those methods which have hindered or increased its improvement in all past ages, etc. London, C. Hitch and L. Haves, 1761.

[21] Comte, August, Article by Viscount Morely of Blackburn in: *Encyclopedia Brittanica*, 11th ed., 1910, vol. 6, 818.

Sir Gilbert Blane [22] discusses in his "Elements of Medical Logic" (London, 1819) the nature of medical truth and of medical error. To learn the truth it is essential, he says, to learn:

> the agencies of nature which are ascertained by observation and experiment: by the former we may be said to listen to nature, by the latter to interrogate her.

He then proceeds to outline the elementary principles of life as giving the sole basis from which disease may be considered. I will spare you the ten headings under which his life principles fall although many of them, such as "generative," "assimilative," and "conservative" (by which term he means the power of blood to resist putrefaction as well as resistance to fever), are translatable into our modern conceptions. Under sources of error he recognizes at once the service that Bacon rendered in "dissipating the clouds of false philosophy." Although Bacon was a giant in intellect, the human mind grows with successive generations, and we: "like the dwarf on the giant's shoulders can see further than could the giant." [23] Blane then outlines the sources of error in medical progress: the syllogistic logic of Aristotle which persisted down through the eighteenth century in spite of Bacon's advice; the failure to recognize variations in the constitution of individual patients; the failure to appreciate the restorative power of nature; and then, in turn, the errors introduced by superstition, by ambiguity of language, and finally through the fallacy of testimony.

The title of Vincenzo Lanza's [24] book "Novum organum medicorum. A New Medical Logic or the Art of Thinking and Right Reasoning Applied to Practical Medicine," arouses great hope of a direct application and extension of the Baconian method. I have

[22] Blane, Sir Gilbert, Elements of Medical Logic. First American from the second English edition, Hartford, Huntington and Hopkins, 1822. (First English edition, London, T. and G. Underwood, 1819.)

[23] Blane, Sir Gilbert, *loc. cit.*, p. 164. Although given as original by Blane this phrase runs back into antiquity. For its origin see Klebansk, Raymond "Standing on the Shoulders of Giants," *Isis*, 1936-37, *26*: 147-149, also Sarton, George, "Standing on the Shoulders of Giants," *Isis*, 1935-36, *24*: 107-109.

[24] Lanza, Vincenzo, Novum organum medicorum. A New Medical Logic or the Art of Thinking and Right Reasoning Applied to Practical Medicine. Tr. by C. Stormont, London, S. Highley, 1826.

found no trace of the Italian original and it was with some difficulty that the abbreviated translation by Stormond, of London, published in 1826, was obtained. It is somewhat disappointing in that the author, although an open admirer of Bacon, has not quite caught the full sense of induction. He deals solely with experience and has not conceived the significance of experiment even in the tentative sense of Gilbert Blane. The first half of Lanza's book, which alone concerns us here, treats of clinical experience and clinical induction, which latter process is defined as "Common reasoning applied to facts in order to measure the relation between them." He does, however, have the wit to perceive the value, and at the same time, the danger, or preconceived ideas which he calls "Hypothetical induction." These preconceived ideas, of the essence of life, health, disease, external causes, and symptomatology, form the basis of fourteen chapters. The remainder of the book deals largely with phenomenology and morbid anatomy. There is no need to detail the author's basis of disease classification except to note that he attributes morbid processes to either excess or vitiation of vital forces and that they then fall into two general classes, namely:

1. "Diseases of grade with changes in degree"; and,
2. "Disease of mode changes in vital forces."

In 1836, Jean Baptiste Bouillaud [25] published his "Essai de Philosophie Médicale," a book of over four hundred pages. This stimulating treatise is an effort to make medicine as much a science as physics. Indeed, for Bouillaud "Medicine is the mechanics, physics and chemistry of the living body." He divides his book into three parts, dealing respectively with:

1. "A philosophical survey of progress in medicine" or, in brief, the history of medicine;
2. "The principles of medical philosophy, or considerations in the art of observation, experimentation and reasoning in medicine"; and finally,
3. "Generalities of clinical medicine."

[25] Bouillaud, Jean Baptiste, Essai de Philosophie Médicale. Paris, de Just Rouvier et E. L. Bouvier, 1836.

It is, naturally, the second section that will occupy our attention for a moment.

After a consideration of the sciences of medicine as viewed by such observers as Descartes and Bichat, our author concludes that the experimental method has been the torch of the natural sciences since Bacon, who also is responsible for refashioning of our understanding of nature and our reasoning about its phenomena. The second and third chapters of this section are particularly striking. The first of these deals with " The spirit or genius of invention, observation, and experimentation with its agents and methods." Disease is in reality a series of experiments. But what constitutes the true observer? How may he be trained and what instruments of precision can he employ? Experimental methods should follow those used in physics. Not even internal phenomena are impenetrable, and even the mental processes may be explored by suitable interrogation. The third chapter deals with theories, logic and systems applied to medicine. The author, although he quotes Chomel, who believes there should be *no* theory, and Bichat, who eschewed too great a generalization, himself believes that: " The faculty of generalization is the most noble of all those that help to build the edifice of Science." Hypothesis must be based on logic and induction, although the latter may lead to error when based on incorrect facts.

A few years later (1839), Auber [26] wrote an even more extended and brilliant monograph with a title that is almost identical with that of Bouillaud, namely, " Traité de philosophie médicale." Adopting the positivism of Comte,[27] the author in his first section, entitled " Questions of medical philosophy," concludes that we had passed through the Infancy or observational era, the Transitional era of vague hypothesis, into Maturity of thought. This era stems from Galileo and Bacon and has adopted induction and the search for experimental causes. Auber's direct quotations from Bacon include:

" Medicine not founded on Philosophy is a weak thing," and
" Analysis is the Secret of Discovery."

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[26] Auber, T. C. E. Edouard, Traité de philosophie médicale. Paris, G. Balliere, 1839.

[27] Comte, August, *loc. cit.*, ref. 21.

Auber's own enlightened aphorisms included such as these: [28]

> Medical logic does not consist simply in the description of phenomena, or in their classification . . . it has the power of abstraction which leads from effects to causes, from phenomena to their forces.

When he comes to consider the history of medical progress it is interesting to find that he dates modern progress from Sauvages, the systematist. The four earlier schools of thought that cover 2200 years are ingeniously described but we cannot linger over them. Some idea of the breadth and originality of this essay may be suggested by some of the chapter headings: " Medicine as a Science and an Art "; " Theory and Practice "; " The Degree of Certainty in Medicine "; and " Contemplation of the Universe."

Camille Bernard [29] wrote in 1843 on the value of doubt in medical reasoning. Bacon had said that " doubt is the school of truth." By doubting the obvious, Descartes had been able to reconstruct science, whereas the ancients used the method to overturn science. False belief lies in accepting another's word blindly.

A year later (1844), Elisha Bartlett,[30] one of the early American peripatetic medical professors, wrote an elaborate book on the " Philosophy of Medical Science." For him science depends primarily on the observation and collection of facts rather than on reasoning about them.

> " The fact-hunter," he says, " as he has been sneeringly called, provided he be also a fact-finder and a fact analyzer, is the only true contributor to the advancement and the improvement of medical science."

Phenomena in one category cannot be deduced by analogy with facts in another series. No knowledge of normal structure, for example, can help us to explain inflammation in any given tissue. In the second part of his book, Bartlett outlines the history and scope of the medical sciences, and is wise enough to see that the ascertained facts are approximative rather than absolute. His definition of pathology

[28] Auber, T. C. E. Edouard, *loc. cit.*, p. 44.

[29] Bernard, Camille, Du doute philosophique en médecine. *Jour. de med. chir. et pharmacol.*, 1844, *2*: 488.

[30] Bartlett, Elisha, An Essay on the Philosophy of Medical Science. Philadelphia, Lea and Blanchard, 1844.

is a broad one for his time, and includes changes in function as well as in structure, causes, and even restorations to normal by means of therapeutics. This embracing concept is followed by several chapters that explain that neither etiology nor therapeutics can be deduced from morbid anatomy. A large part of Bartlett's book is devoted to the consideration of therapeutic laws. He lays down wise rules of proof for determining the efficacy of a given drug. Therapeusis, to him, is based entirely on empiricism. No hypothesis, no experimentation on animals is provided for. He makes many wise suggestions for progress, such as a return to the study of the nature of life, and makes the statement that " although chemistry does not end outside the body, the body is more than a chemical laboratory."

On the other hand, as Edward Thompson [81] pointed out, medical students in 1852 were (and, I might add, still are) in particular need of training in sound habits of reasoning. Medicine has tended too much to the acquisition of facts and has afforded much less training in logic than have Law and Divinity. The student rushes into empirical practice, adopting the routine of his instructors. Although Baconian induction, extending as it does from particulars to universals, is the most important method in the acquisition of new knowledge, deduction, too, is necessary in the proof of specific instances. Lasègue [82] took a similar viewpoint and emphasized that, although fact-finding is most important, behind the current accumulation of facts lay Bacon's " idea " rather than Newton's discoveries. We find Edward Dunster,[83] too, as late as 1873, pleading anew for a study of the logic of medicine.

It was evident to Oesterlen,[84] in the middle of the nineteenth century, that medicine at that time had progressed only so far as had chemistry in the age of alchemy. In his elaborate treatise on " Medical Logic " this German author attempts to order the facts that had

[81] Thompson, Edward, Logic, in Its Relations to Medical Science. *Ohio Med. and Surg. Jour.*, 1851-2, *4*: 185.

[82] Lasègue, E. C., *De la logique Scientifique et de ses applications médicales. Arch. gén. de méd.* 6s 1868, pt. 1, *11*: 715.

[83] Dunster, Edward S., The Logic of Medicine. *N. Y. Med. Jour.*, 1873, *17*: 249.

[84] Oesterlen, F., Medical Logic. Trans. by G. Whitley, London, Sydenham Society, 1855. (First German ed., 1852.)

been attained. He covers, indeed, the entire history of medical thought. The Art of medicine had preceded not only medical science but medical reasoning. Simple observation was not in most instances sufficient to explain how disease arose. Bacon's " ars interrogandi et interpretandi naturam " was essential to future progress. Oesterlen proceeds to analyze in detail observation, hypothesis, experiment, and the methods of right reasoning from them. His essay is significant from his comparison of progress in the several sciences. He sees that physics and mechanics are largely deductive sciences, but physiology cannot be explained so simply because vital processes are more complicated. But it is easier, however, for the physiologist than for the pathologist to separate out the factors involved in their respective phenomena:

> The properties and modes of operation of the complicated influences and agents with which we deal (e. g. marsh land, weather, bad food, and the like) are still not understood.

This sentence indicates how medical philosophers even late in the last century were adrift in a labyrinth of vague causality without a thread to guide them. Hope would lie, our author concludes, in a continued " teasing of nature," " vexatio naturae," as Bacon had called it, through experimentation. That method is the one that will " start up the game," as Newton expressed it when they told him that he had exhausted all the game and left nothing more to be hunted or discovered. " There is game enough in every bush," he said, " if one knows how to start it."

In 1858, Francis Ogston [35] was Professor of Medical Logic and Medical Jurisprudence in Marischal College, Aberdeen and, as the syllabus of his course informs us, delivered a series of no less than *thirty-two* lectures on medical logic. Extracts from this outline of his course may enlighten us as to the significance of the subject as he conceived it. He took a lecture to explain why a separate chair of Medical Logic was necessary; logic, deductive and inductive, were explained; medical history before Bacon was outlined. The influence

[35] Ogston, Francis, Syllabus of the course of lectures on medical logic, delivered in Marischal College and University, Aberdeen. Edinburgh, Maclachlan and Stewart, 1858.

of Bacon and Descartes on the analysis of nature was discussed, and both the value and the defects of the Baconion method were explained. Why should we distrust theory?—is one of the questions raised. A contrast is made between the Art and the Science of medicine; the arrangement and interrelationship of the medical sciences are explained. The inductive method is the same in medicine as in other sciences. There is danger in argument from analogy; one should observe and "vary the circumstances," as Bacon advised. Analogy, comparison, imagination, and statistics are separately treated. The successive stages of deduction and induction are considered in detail. The value of experiment is given. The methods of experimental inquiry are allotted an entire lecture. "Hypothesis," "language," "description," "classification," "nosology," and finally, "fallacies" afford material for several hours' discussion. One wonders, indeed, how Ogston spun his philosophy into so long a thread.

This reasoning about discovery in order to promote discovery may be said to have reached its climax in Claude Bernard's [36] famous "Introduction to the Study of Experimental Medicine" (1865). This magnificent treatise differs from its immediate predecessors in its higher level of reasoning, because it is the working philosophy of a great discoverer. I know of no way to appraise or to summarize this magisterial thesis on medical logic except through quotation and paraphrase arranged in an order that is my own.

Bacon's account of science looks good from a distance although it is of little value as a progress chart for an experienced scientist. Bacon had advocated recourse to nature rather than to books. Indeed:

> Baconian induction has become the basis of scientific philosophy. He felt the sterility of scholasticism . . . and foresaw the experimental method although he could not use it.[37]

Bacon's ruling out of negatives implies the "doubt that is one of the foundations of experimental method." "The experimenter's dubitative reasoning may be called inductive, whereas the mathematician's affirmative reasoning is deductive." The investigative or

[36] Bernard, Claude, *loc. cit.*, Ref. 4. [37] Bernard, Claude, *loc. cit.*, p. 51.

interrogative reasoning is inductive and belongs to experiment. In short, "one must believe in science but doubt its methods of investigation." A counter proof, or as we should say, a "control," is needed. The relationship of cause to effect is proved by removing an accepted cause and seeing whether the effect persists. And experiments should be performed not to confirm our ideas but to control them.

Bacon confused experiment and observation. "Observation is the simple registering of a fact; experimentation the control of an idea by a fact." Correct reasoning is the same in observational and experimental science, but the latter depends on an idea that is followed by the provocation of facts.

The experimenter is active and questions nature and although he listens to her he never replies to her or listens inattentively.[38]

In experimentation a preconceived idea is required, and to elicit this idea a "groping about" (*tâtonment*) is necessary, and the imagination must be given free rein.

Even mistaken hypotheses and theories are of use in leading to discoveries. . . .[39] We are all likely to make mistakes, except those of us who do nothing.[40]

No rule can be given for originating a correct and fertile experimental idea.

"We usually think of discovery," says Bernard, "as the recognition of a new fact but I think that the idea connected with the discovered fact is the real discovery. . . ." [41]

Feeling is the *primum movens* of science. Genius is revealed in a delicate feeling which correctly foresees the laws of natural phenomena; but this we must never forget, that correctness of feeling and fertility of ideas can be established and proved only by experiment.[42]

Scientific invention consists in the creation of fortunate and fertile hypotheses.[43]

Statistical tables never establish experimental demonstrations.

[38] Bernard, Claude, *loc. cit.*, p. 23.
[39] Bernard, Claude, *loc. cit.*, p. 170
[40] Bernard, Claude, *loc. cit.*, p. 176.
[41] Bernard, Claude, *loc. cit.*, p. 33.
[42] Bernard, Claude, *loc. cit.*, p. 43.
[43] Bernard, Claude, *loc. cit.*, p. 220.

Such tables are supposed to create laws, but "scientific law can be based only on certainty, on absolute determinism, not on probability."

It is safe to assert that the "*filum labyrinthi*" that Bacon had postulated as necessary in tracing the maze of nature lay in the thread of causation. Centuries earlier, Vergil [44] had said: "*Felix qui potuit rerum cognoscere causas*," and a desire to know the causes of things must always have underlain man's lust for the exploration of nature.

I am well aware that the nature, indeed the very existence, of "Causality" has been debated by philosophers from Leucippus and Aristotle to Kant and Bergson. Are we to relapse to the older and persistent anthropocentric idea that results are predicated by causes or, on the other hand, are we to believe that cause is a fiction of the mind, an epiphenomenon, simply one in a series of miracles, that comprise the cycle of events? I don't see how any physician can hesitate to accept the elementary and ancient explanation that an essential, efficient, primary, or remote cause conditions a given effect. Of course we may well debate whether the old proposition "*Causa aequat effectum*," whether cause and effect are equivalent, is exact. We may say with Hueppe [45] and Löhlein [46] that no strict "*ens morbi*" exists because several different causes produce a similar disease, or in reply we may retort that although similar, they are *never* identical. It is easier to explain the several symptoms or lesions that may result from a single cause if we admit a fluctuating virulence or adaptation in a living infectious agent, or else a localized sensitization of a given organ or tissue. The streptococcus offers an example of what I have in mind. The particular variety of this organism which is concerned in scarlet fever has never yet been clearly separated from those that produce septic sore throat, puerperal fever, or erysipelas; and yet the manifestations of each of these diseases are as far apart as can be imagined. They may, however, depend entirely on which part or tissue of the body is hypersensitive.

[44] Vergil (Publius Vergilius Maro) Georgics. Second Book, verses 490-492.

[45] Hueppe, F., Ueber die Ursachen der Gährungen und Infektionskrankheiten und deren Beziehungen zum Causalproblem und zur Energetik. Verhandlungen der Gesell. deutscher Naturforscher und Aertze. 65 Meeting. Leipzig, Vogel, 1893.

[46] von Löhlein, M., Ursachenbegriff und Kausales Denken. *Med. Klin. Berl.*, 1917, *13*: 1314.

Bacon [47] had a very clear insight of the indirect method by which our knowledge of causes has been attained when he says:

> Celsus, a wise man, as well as a physician, speaking of the empirical and dogmatical sects of physicians, gravely and ingenuously acknowledges that medicines and cures were first discovered, and the reasons and causes of them discoursed afterwards, not that causes, first derived from the nature of things gave rise to the invention of cures and remedies.

The purpose of experiment is the search for causes, for he says in the 99th aphorism of his "Novum Organum":

> But our hope of further progress in the sciences will then only be well founded when numerous experiments shall be received and collected into natural history, which although of no use in themselves assist materially in the discovery of *causes* and axioms; which experiments we have termed enlightening to distinguish them from those which are profitable.

The medical philosophers of the early nineteenth century were appalled at the complexity of the life sciences; and life in its pathological aspects was still more baffling. And yet, Sir Gilbert Blane (1819) clearly saw that "knowledge of the agencies of nature is essential" to further progress in knowledge of the principles of life and of disease. Bartlett was near enough in thought to the experimental approach to realize that deductions from pathological anatomy would not alone suffice, and he at least felt sure that the body is something more than a chemical laboratory.

Throughout this whole period of Medical Logic there was a spirit of hopelessness of discovering the true causes of disease. Bouillaud said: "First causes are in their essence an impenetrable secret," an idea that was subsequently reiterated by a lesser writer, Camille Bernard, who said: "*Les vraies causes premières des phenomènes morbides nous serout toujours cachés.*" Auber quotes Azais: "Man knows all except the *cause* of all." Jackson,[48] Bartlett, and even so late a medical philosopher as Oesterlen (1852) were equally pessimistic as to the ultimate solution of the nature of disease causation.

[47] Bacon, Francis, *loc. cit.*, p. 184.

[48] Jackson, James C., Logic Applied to Medical Science. *Proc. Connect. Med. Soc.*, 1860-63, 1: 2s, 245.

Claude Bernard did far more than make fundamental contributions to normal and pathological metabolism, and establish the methodology of animal experimentation. Although he felt, with his predecessors, " that the nature or very essence of phenomena, whether vital or mineral, will always remain unknown," [49] he recognized that the methods of discovery in both living and inorganic sciences are the same: [50]

" The spontaneity of vital phenomena does not remove them from laws that prevail over inorganic bodies," he says.[51]

Vital phenomena are more complex in that they are " doubly conditioned," that is to say, they are controlled by both internal and external factors, and " although we desire to know the ' why ' of things we can at present reach only the ' how.' " And finally, however difficult and seemingly hopeless the task may be:

The object of experimenting physicians is to discover and grasp the original causation of a series of obscure and complex morbid phenomena; as a result they will dominate all secondary phenomena. . . .[52]

I deliberately fraction the remarkable sentence that Bernard wrote to give greater emphasis to his foreseeing conclusion. He continues:

. . . thus we have seen that, on mastering the tick ('Sarcoptes scabei') which causes the itch we naturally master all the derived phenomena.

In another place [53] he mentions this early discovered living disease agent as illustrative of the method by which empirical medicine can become scientific.

Claude Bernard could not know that with the further development of parasitology and with the advent of protozoology, bacteriology, and mycology, would come recognition of the essential and specific causation of roughly one-half of the disease entities. He could not know that with the successive triumphs of these new sciences would come knowledge of the specific etiology of many of the most epidemic and devastating of diseases. Nor could he foresee the tri-

[49] Bernard, Claude, *loc. cit.*, p. 61.
[50] Bernard, Claude, *loc. cit.*, p. 69.
[51] Bernard, Claude, *loc. cit.*, p. 60.
[52] Bernard, Claude, *loc. cit.*, p. 216.
[53] Bernard, Claude, *loc. cit.*, p. 214.

umphs of specific diagnosis, prevention and therapy that followed. And of course the end is not yet in discovery of the living agents of disease or in the field of applied immunology.

As late as 1873 Edward Dunster [54] said in his address on the "Logic of Medicine":

> In almost every prominent theory, disease is something that is added to the body and which is to be removed. But the present tendency is to believe that disease is only a perverted healthy process, something less as it were than life and out of it has come the prevailing system of theraupeutics—the restorative method.

At all events the methodology of the experimental study of disease etiology has been roughly outlined during the past fifty years, and its field of discovery has been fruitfully if not fully tilled. We have endeavored to outline in what manner discovery of method and discovery of fact have been preceded by logical thought.

Have I merely been parading before you a closed and forgotten chapter of medical history, interesting, perhaps, to the antiquarian but with no applicability to present day interest and needs? I think not. I believe with Abraham Wolf [55] that, "The world (of science) needs a new intellectual orientation"; a recourse again to a new medical logic that will usher in a new era of fact-finding. It is my feeling that our outlook towards future discovery is in a way obscured by the winrows of accumulated fact that lie about us. To use a homely expression: "We cannot see the woods for the trees."

My main conclusion lies in advocating a new recourse to scientific logic in the sense of Francis Bacon, to a "taking thought for the morrow," in spite of the Biblical injunction to the contrary. The last wave of pure reasoning, beginning three centuries ago, would seem, indeed, to have started something. Experimentation and inductive logic, doubt, and the penetration into the field of causation, have carried us thus far in the process of unraveling nature. Do we now need a new kind of reasoning? I leave this to the examination of the logicians in whom I have more confidence for their stimulus to

[54] Dunster, Edward S., *loc. cit.*, Ref. 33.

[55] Wolf, Abraham, A History of Science, Technology and Philosophy. London, George Allen and Unwin Ltd., 1935.

scientific discovery than some of my fellow experimenters would grant them.

This is not the place to emphasize too fully the degree to which the evolution of thought and the accumulation of fact on the more complex problem of disease has enlightened the problem of the normal aspects of vital phenomena. This "pathological" approach to an understanding of normal life processes has been of all the most fruitful; degenerated tracts in the central nervous system led to the localization of the pathways of normal nerve fibers; the various forms of insanity that overemphasize single emotional urges have clarified the understanding of normal thought processes; the mental hygiene of industry that would locate the psychopathic disturbers of traffic, as Southard [56] pointed out when he started to develop this field twenty years ago, may yet lead to an heuristic understanding and cure of labor unrest.

What we now need, I believe, is a new line of approach to a very old problem, namely, to the nature of life. I foresee, not, in all probability, the centuries that have been required to establish the methods of experimentation that have given us real insight into the nature of causes, but years at least before the essential nature of life is revealed. Claude Bernard gave us real hope through his insistence that biological problems are not only approachable experimentally, but that the laws of life are essentially those that govern inorganic bodies. Vital phenomena differ from inorganic phenomena in their spontaneity, their unpredictability. The complexity of life is expressed by saying, as did Bernard, that they are *doubly conditioned*, or have an "intraorganic environment" that separates them from inorganic bodies. Modern intra-atomic physics would, however, seem to obliterate as well this apparent difference. Furthermore, according to this author,[57] living things have three kinds of properties: physical, chemical, and vital, and the latter will perhaps one day be resolved in terms of the other two.

How far have we progressed since Bernard in the definition of

[56] Southard, E. E. The Movement for a Mental Hygiene of Industry. *Mental Hygiene*, 1920, *4*: 43-64. See also: "The Open Mind: Elmer Ernest Southard 1876-1920," by Frederick P. Gay, Normandie House, Chicago, 1938.

[57] Bernard, Claude, *loc. cit.*, pp. 63-65.

"Life"? The materialistic description of vital properties that has just been given would be modified by Johnstone,[58] who says:

> It does not mean because no activities other than those of physics and chemistry are known, that no others exist. For the methods employed would not lead to the detection of other activities. . . . Physics and chemistry do not *explain* life, they *describe* it.

A further rehabilitation of the still despised vitalism is given by an eminent physicist and chemist, G. N. Lewis,[59] when he says in discussing probability and entropy:

> But the observation of animate nature leads to the almost irresistible conviction that here emerges into our perception a new element, alien to the randomness that characterizes the physical sciences; indeed, that living creatures are *cheats* in the game of physics and chemistry. It seems that animate creatures alone are striving for distinction in the midst of the almost overwhelming leveling forces in the great democracy of atoms.

Or are we to lull ourselves in the lap of mechanism as does Augusta Gaskell[60] who would explain life in terms of intra-atomic physics, as a novel "Z" combination of protons and electrons separate from those combinations that account for the known chemical elements. Blum[61] recently defined life as, "A photochemical steady state . . . with an energy exchange that is not contrary to the second law of thermodynamics."

To explain life on a purely mechanistic basis seems to me simply a return to deductive methods of reasoning. For instance, Liebig's explanation of fermentation was deductive and Pasteur's introduction of experiment, of induction, and of a living cell was needed to set it right.

Turning to more positive descriptions of the nature of life we find that one definition[62] prescribes three criteria: "Metabolism, with the power of growth; reproduction; and, finally, automatic or

[58] Johnstone, J., Mechanism of Life in Relation to Modern Physical Theory. London, Longmans Green and Co., 1921.

[59] Lewis, Gilbert N., The Anatomy of Science. New Haven, Yale University Press, 1926.

[60] Gaskell, Augusta, What is Life? Springfield, C. C. Thomas, 1928.

[61] Blum, Harold F., Life; A Photochemical Steady State. *Science*, 1937, *86*: 285.

[62] Funk and Wagnall's *New Standard Encyclopedia*, New York, 1931.

internally initiated adaptations to changes in the environment." Noel Paton would enlarge the first criterion of metabolism to " The power to use energy derived directly or indirectly from the sun," and add the important property of " conservation of a particular particulate form."

Reproduction may at least be simulated in the crystallization of supersaturated chemical solutions, but the spontaneity, unpredictableness, adaptability, and distinction of life entitles it to our attention apart from our personal interest in this elevated phase of nature.

The new approach to an understanding of life lies, I believe, in the pathological approach on which I lingered a moment ago. Claude Bernard was wise enough to say: [63]

> The mechanisms of life can be unveiled and proved only through the knowledge of the mechanisms of death.

It may well be that in the present-day discussion of the virus diseases, a discussion that centers about the animate or inanimate nature of their provoking agents, we shall gain a new conception of life itself.

The viruses, although so small that, by definition, they pass through filters that retain most bacteria, vary considerably in size; and by means of a series of collodion membranes they can be accurately graded. They range roughly in size from ten to one hundred and fifty millimicrons. Many of the larger virus particles, like those of vaccinia, produce characteristic changes within the cells they affect in the form of " elementary bodies," which some of us have come to accept tentatively as living, morphological units. These bodies do not differ much in size and appearance from the Rickettsia which are generally accepted as living units. In point of view of adaptability, reproduction, and antigenicity, viruses agree with living cells. Little or nothing is known as to their metabolism for they seem only to grow in tissues that have a metabolism of their own.

On the other hand, there is a newly emerging body of evidence that would identify certain of the smaller viruses, at least, with enzymes. Northrop [64] has crystallized not only pepsin and trypsin

[63] Bernard, Claude, *loc. cit.*, p. 99.

[64] Northrop, J. W., Bacteriophage. *Science*, 1936, *84*: 190.

but their precursors, pepsinogen and trypsinogen. They are definitely high molecular proteins and are antigenic. Although strictly speaking they cannot be said to reproduce, they are, like inorganic catalysts, at least not sensibly used up in their action, and by autocatalysis may actually increase in amount. In a sense enzymes are adaptable in that they are apparently not active in proenzymes until a specific substrate is present. Furthermore the virus of tobacco mosaic has apparently been crystallized by Stanley.[65] Are we perhaps dealing here, it may be only in respect to the smaller viruses, with chemical protein complexes in the nature of enzymes which may be crystallizable and have many of the attributes of living organisms without themselves being alive?

The future, and perhaps the not too distant future, will answer such questions and other questions that will grow out of the answers. Here at least seems the highway of exploration of the most fundamental of all biological questions—the nature of life. Do we need a new kind of logic to guide us in solving this great problem, or will Baconian inductive logic suffice? At least we need to *reason* with renewed vigor and accuracy.

[65] Stanley W. M., Isolation of Crystalline Protein Possessing the Properties of Tobacco Mosaic Virus. *Science*, 1935, *81*: 644.

THE BIOGRAPHICAL ESSAYS OF SIR WILLIAM OSLER AND THEIR RELATION TO MEDICAL HISTORY *

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" To a lifelong interest in biography as a recreation I have added a strong conviction of its value in education."

—*William Osler.*

It has often been pointed out that Osler believed that a necessary complement to the study of a man's work is the study of his life, a method to which he gave the name *bio-bibliography.* All his efforts as a biographer concentrated either on making a forgotten man live again, as in " An Alabama Student," or on exhuming a forgotten side of a man already great, as in the Locke essay.

This " forgotten side " was always the medical one. Osler gave a great impetus to the study of medical history in all its aspects, and the principal sources from which he drew were biographical. Dr. Raymond Crawfurd's testimony on the subject is enlightening:

> I saw a great deal of Osler in connection with the Section of History of Medicine at the Royal Society of Medicine. He was its father, and I doubt if it would ever have come into existence but for his quickening influence; . . . his own contributions were few and mainly biographical, and I do not think anyone could have discovered from them how fully he possessed the true historical sense, but his faculty of extracting contributions on every conceivable aspect of medicine from the most unproductive sources was invaluable to the Section; and that Osler was in the chair was a sure draw.[1]

And this same quality was often noticed by others. Besides his genius for discovering sources, he had also a genius for stimulating others to an interest in medical history. His Silliman lectures on *The Evolution of Modern Medicine* [2] were intended as just such a

* Prepared for Professor Gilbert G. Benjamin's Seminar in Modern European History, University of Southern California, August, 1938.

[1] Quoted in Harvey Cushing, *Life of Sir William Osler* (Oxford, 1926), II, 324.

[2] William Osler, *The Evolution of Modern Medicine* (New Haven, 1921). Osler describes this work as " an aëroplane flight over the progress of medicine through the ages."

stimulant, and other efforts have been commented on appreciatively by J. A. Chatard of Johns Hopkins University, who said that "It is only by thus fostering and helping along a search for old truths that the newer ones assume a more crystalline appearance and we are better able to value them in the light of advancing thought." [3]

Thus it was largely in the spirit of turning up material for the work of medical historians, as well as furnishing a more fully rounded picture than is ordinarily to be found of the men he treats, that the biographical studies he has left were written. In tracing the sources of these essays one finds a vast array of both primary and secondary materials; but only in rare instances did he rely on those sources of a secondary nature. His years of work on his library—his love of this work in which, among other things, he collected every edition of Sir Thomas Browne's *Religio Medici*—placed in his hands original editions of the writings of those who became the subjects of his biographical sketches. Among the more than seven thousand volumes listed in his *Bibliotheca Osleriana* [4] are some 250 by and about William Harvey, many of them original copies; [5] and more than 200 by and about Sir Thomas Browne selected from various editions.[6]

Besides the earliest editions of works by the men he was writing of, Osler secured letters, copies of contemporary opinions of the man, periodical articles, and every other conceivable scrap of out-of-the-way information. One essay, "An Alabama Student," grew out of his interest in an obscure Southern doctor, one of whose works he discovered in an old medical journal. His later information, which served as the basis of the essay, came from a packet of letters from this doctor, sent to Osler by the doctor's daughter. For information on Thomas Dover he went even beyond the British

[3] J. A. Chatard, "Osler and the Book and Journal Club," in Henry M. Thomas, Lewellyn F. Barker, W. T. Councilman, *et al.*, *Sir William Osler, Bart., Brief Tributes to His Personality, Influence, and Public Service* (Baltimore, 1920), p. 96.

[4] William Osler, *Bibliotheca Osleriana* (Oxford, 1929), an annotated catalog of a library collected to give a view of medicine in all the ages; the books now form the nucleus of the Osler Library at McGill University, Montreal.

[5] *Ibid.*, Nos. 692-838.

[6] *Ibid.*, Nos. 4416-4610, *et passim* (cf. index, p. 718).

Museum, and his collateral reading took in as remote a source as Smollett's *Peregrine Pickle*.[7] And he composed his admirable account of Keats's medical work thus:

> He had been reading the new edition, by Forman, of Keats's letters, meanwhile saturating himself with the poems, and the details of Keats's life, in full sympathy and understanding with one "who unhappily had missed the *Spes phthisica* that has carried so many consumptives cheerfully to the very gates of the grave." [8]

Christopher Morley says that Osler's essay on Keats, "taken with Kipling's wonderful story *Via Wireless*, tells the student more about that poet than many a volume of biography." [9]

Although Osler stresses the medical side of his subjects, he never allows this to overbalance him. He never overlooks the real contribution of the man to the world—Keats the poet, as well as Keats the surgeon; Locke the philosopher, as well as Locke the physician; and Holmes the essayist and poet, as well as Holmes the anatomist. Although it is his purpose to extract here material valuable to the study of medical history, he never forgets that this material is valuable only as it is seen in its proper proportion to the subject's other work. Thus we have as Osler's legacy to biography a series of well-conceived brief studies which bring out the material of medical history without inflating it overmuch, and without creating an unbalanced view of the subjects. Withal, Osler expressed himself with great literary ability, drawing upon his wide reading for appropriate quotations from hundreds of the great works of literature. "One could get a liberal education in literature merely by following up all his quotations and references." [10]

[7] Harvey Cushing, *op. cit.*, I, 410-411.

[8] *Ibid.*, I, 423.

[9] Christopher Morley, ed., *Modern Essays* (New York, 1921), p. 128.

[10] *Loc. cit.* Morley says he would like to see Osler's "honorable place as a man of letters more generally understood. . . . Rich in every gentle quality that makes life endeared, his books are the most sagacious and helpful of modern writings for young students." Last year I completed an exhaustive inquiry into *The Literary Concerns of Sir William Osler* for the Master of Arts degree at the University of Southern California. This study gives ample grounds for classification of Osler among men of letters, and shows his literary work to be of high merit, and worthy of further consideration as literature.

II

"An Alabama Student" was read at the Johns Hopkins Hospital Historical Club in January 1895 and was first published in the *Johns Hopkins Hospital Bulletin*, Number 58, January 1896. In his own words, Osler tells how he came to write of this unknown Southern doctor of the mid-nineteenth century whom he elected to rescue from oblivion:

> When looking over the literature of malarial fevers in the South, chance threw in my way Fenner's *Southern Medical Reports*, vols. i and ii, which were issued in 1849-50 and 1850-51. Among many articles of interest, I was particularly impressed with two by Dr. John Y. Bassett, of Huntsville, Alabama, in whom I seemed to recognize a "likeness to the wise below," a "kindred with the great of old." I wrote to Huntsville to ascertain what had become of Dr. Bassett, and my correspondent referred me to his daughter, from whom I received a packet of letters written from Paris in 1836. I have her permission to make the extracts which are here given.[11]

Thus Osler began this story of "one who heard the call and forsook all and followed his ideal"—an account so appreciative it is impossible to read it without feeling a real sympathy for those voiceless,

> for those who never sing,
> But die with all their music in them.

Bassett's story is that of a young Southern doctor who, burdened with the responsibilities of supporting a family and keeping up a practice, yet burned constantly with the desire to visit great centers of learning; and after a bitter struggle for courage to leave his wife and children "for the sake of his profession," he sailed for England in January 1836. His letters are descriptive of Manchester, York, and Edinburgh, and later of London and Paris. He studied at Velpeau's clinic at *La Charité*, attending lectures there and getting himself appointed *externe*. Early in 1837 he returned home.

The two papers in the *Southern Reports* which so took Osler's interest gave full accounts of smallpox and scarlet fever, and Osler quoted from them rather extensively, calling particular attention to

[11] William Osler, *An Alabama Student and Other Biographical Essays* (New York, 1908), p. 2.

Bassett's high ideals of careful study and continued advancement for the benefit of the profession and mankind. These papers were the products of an " even-balanced soul who ' saw life steadily and saw it whole.' " [12] " Rarely has the *credo* of a zealous physician been more beautifully expressed." [13]

The last letter in the packet is dated 16 April 1851; the Alabama Student, just forty-six, died in November of that year of tuberculosis. The essay closes with these words:

> To have striven, to have made an effort, to have been true to certain ideals—this alone is worth the struggle. Now and again in a generation, one or two snatch something from dull oblivion; but for the rest of us, sixty years—we, too, are with Bassett and his teachers, and
>
> No one asks
> Who or what we have been,
> More than he asks what waves,
> In the moonlit solitudes mild
> Of the midmost ocean, have swelled,
> Foam'd for a moment, and gone.[14]

" An Alabama Student " is an instance in which Osler has made to live again a man some years forgotten, who he thought illustrated perfectly the ideal actions of the average practitioner. This is not to say that Osler wished to resurrect and glorify mediocrity; quite the opposite. In Bassett he discovered a true genius for leading a commonplace life in an ideal way, for rendering the highest service to his fellow men consistent with his position in life. Osler's thought here is that Bassett filled his place well, and his life can therefore well serve as a lesson to succeeding generations.

The importance of this essay lies in its power to humanize and bring to life again the frontier physician of the mid-nineteenth century.[15] The trials and ideals and almost hopeless aspirations of these

[12] *Ibid.*, p. 11. [13] *Ibid.*, p. 16. [14] *Ibid.*, p. 18.

[15] In this wise Osler is responsible for the beginning of an epoch in historiography of medical history. It should be remarked that most of the authors who have followed in his footsteps have succeeded in making mere popularizations; the culmination of the epoch has come, however, in a book in the true Oslerian tradition: James T. Flexner's *Doctors on Horseback: Pioneers of American Medicine* (New York, 1937) humanizes its subjects without vulgarizing them, and is worthy of careful study as to method of treatment.

conscientious men as they struggled against odds to bring medical learning to the frontier are made vivid and alive. This sort of treatment is necessary before an accurate and appreciative history of the period can be written.

III

From the obscure, naïve, and struggling Dr. Bassett it is a long jump to the urbane and learned Dr. Oliver Wendell Holmes, whose life and accomplishments Osler treated in an appreciative essay read to the Johns Hopkins Medical Society on 15 October 1894 as an obituary address, Holmes having died the week before. Osler's connection with the Autocrat had been close, and he was always a great admirer of Holmes. Osler's writings abound with quotations from Holmes,[16] and it may be said that Holmes's works meant more to him than any others in American literature. His list of ten books in the "Bedside Library for Medical Students"[17] begins with the Scriptures and Shakespeare and ends with the "Breakfast Table" series.

Osler had read Holmes before he went to Philadelphia. His last "Notes and Comments" in the *Montreal Medical Journal* (January 1889) contains remarks on Holmes's new book *One Hundred Days in Europe*. In that work Holmes "mentions having sat next to Mr. Lawson Tait at dinner and he suggests the question, 'Which would give most satisfaction to a thoroughly humane and unselfish being of cultivated intelligence and lively sense—to have written all the plays which Shakespeare has left for an inheritance to mankind, or to have snatched from the jaws of death scores of suffering women and restored them to a sound and comfortable existence?'"[18] Osler thinks Holmes the proper person to answer such a question: "Would he rather go down to posterity as the man who, in this country at least, first roused the profession to a sense of the perils of puerperal fever as an infectious disease . . . or would he

[16] Cf. William Osler, *Bibliotheca Osleriana*, Nos. 2987-3000, 4937-4955.

[17] Appended to William Osler, *Aequanimitas with Other Addresses* (Philadelphia, 1930).

[18] Quoted by Harvey Cushing, *op. cit.*, I, 301-302; *cf.* also William Osler, *An Alabama Student and Other Biographical Essays*, pp. 64-65.

choose to be remembered as the author of 'The Pearly Nautilus' [*sic*] and 'The Last Leaf?'" . . . .

In the essay on Holmes [19] Osler tells that he was so interested to discover what Holmes's answer to this question would be that he wrote to the Professor and received the following reply:

"I think I will not answer the question you put me. I think oftenest of the *Chambered Nautilus*, which is a favourite poem of mine, though I wrote it myself. The essay only comes up at long intervals. The poem repeats itself in my memory, and is very often spoken of by my correspondents in terms of more than ordinary praise. . . . There is more selfish pleasure to be had out of the poem—perhaps a nobler satisfaction from the life-saving labour." [20]

That Holmes's fight for the recognition of puerperal fever as an infectious disease struck Osler as being a great work is evidenced by the fact that he calls Holmes's paper on the subject "a classic in American literature" [21] and by his belief that Holmes was "the most conspicuous modern example of success in both fields" of literature and of medicine.[22] Holmes's paper, "The Contagiousness of Puerperal Fever," had been read before the Boston Society for Medical Improvement in 1843 and published in the *New England Quarterly Journal of Medicine*. It was full of bold statements, and its resolute tone aroused the antagonism of those who were opposed to the theory of the contagion of the fever, giving rise to the historic reply of Meigs and Hodge. Holmes, however, settled "those two Professors" by reprinting his essay in 1855 as *Puerperal Fever as a Private Pestilence*, from the new introduction of which Osler quotes the following classic paragraph:

They [students of medicine] naturally have faith in their instructors, turning to them for truth, and taking what they may choose to give them; babies in knowledge, not yet able to tell the breast from the bottle, pumping away for the milk of truth at all that offers, were it nothing better than a professor's shrivelled forefinger.[23]

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[19] William Osler, *An Alabama Student and Other Biographical Essays*, pp. 55-67.
[20] *Ibid.*, pp. 65-66.
[21] Quoted by Harvey Cushing, *op. cit.*, I, 302.
[22] Quoted, *ibid.*, I, 301.
[23] William Osler, *An Alabama Student and Other Biographical Essays*, p. 64.

Essays of this nature Osler properly feels belong in the classification of literature.

In picturing Holmes, Osler again attempts successfully to balance the view between different sides of the man. In "An Alabama Student," the attempt was to re-create a whole man, lest he be forgotten entirely; in the Holmes essay, the purpose is to recreate a whole man, lest a significant and important part of him be forgotten. However Holmes would have wished to be remembered, as the champion of diseased women or as the poet, posterity is most likely to forget his less appealing, less spectacular medical work. Holmes's fight against stupidity and bigotry is a landmark in American medical history. His medical writings should rightly be studied with his literary prose and poetry, and to this end Osler finishes his essay with the remark that he is thankful that Holmes's medical essays were reprinted with his works.[24]

IV

Like "An Alabama Student," the Thomas Linacre address made in May 1908 at St. John's College, Cambridge, is a high-point in Osler's essays in the field of medical history. The essay [25] is divided into four parts: the Introduction and the Life of Thomas Linacre; Linacre as a Medical Humanist; Linacre as a Grammarian; and the Linacre foundations. The nature of this division readily indicates Osler's constant attempt to orient his medical history material in its relation to the whole man.

Again in this essay, the secondary sources are few and for the most part elemental. Osler acknowledges his indebtedness to Johnson's *Life* (1835 edition), to the articles on Linacre in the *Dictionary of National Biography* and in the reprint of *de Temperamentis* by Dr. J. F. Payne, the learned Harveian Librarian of the Royal

[24] *Ibid.*, p. 66.

[25] William Osler, *Thomas Linacre* (Cambridge, 1908). The essay is strongly bibliographical as well as biographical; but with this material the present paper is not interested. Osler's wide pursuits as an amateur bibliographer and critic of letters will be treated in a later paper. Cf. also William White, "Sir William Osler as a Critic of the Novel," *Medical Record*, CXLVIII (2 November 1938), 340-342.

College of Physicians.[26] But for the most part he has relied upon Linacre's innumerable works in the British Museum and in Osler's own private collection.[27] These he has gone over with minute attention to interesting detail, and he includes in the printed volume of the essay nine plates, facsimiles of sample pages from various early Linacre editions.

After a brief introduction treating of the lectureships, in which he commented on Oxford men who establish lectureships at Cambridge (which may have shown his own self-consciousness as an Oxonian),[28] Osler sketches briefly the life of Linacre: "Canterbury gave him his birth (1460) and Oxford his education; he was chosen in 1484 Fellow of All Souls"[29] This is elaborated on, and is followed by an understanding interpretation of the part Linacre played in the English Renaissance:

> Not until Greece rose from the dead did light and liberty come to the human mind, and it is the special glory of Linacre that he became, as Fuller says, the "restorer of learning in this country."[30]

And he goes on to tell the story of how Linacre became impregnated with the classic tradition at Oxford, how he traveled on the Continent, and how he received from the scholar Hermolaus Barbarus the ambition to study medicine. He received his medical education at Padua and returned home through Italy and France. Back at Oxford, he taught Greek, probably practiced medicine, and, with the great scholars Grocyn, Latimer, and Colet, promoted the new learning.

Early in the sixteenth century Linacre's work as translator[31] and

[26] *Ibid.*, pp. 63-64.

[27] *Cf.* William Osler, *Bibliotheca Osleriana*, Nos. 366-369, 372-378, 385-387, 389-390, 5054-5066.

[28] The appointment of Osler to give one lecture was a departure from custom. Previous appointments to the lectureship had extended over a four-year period. The new arrangement was made out of deference to the many calls on Sir William's time.

[29] William Osler, *Thomas Linacre*, pp. 4-5. Osler has here quoted from Freind's *History of Physic* (London, 1726), 3rd edition, vol. II.

[30] William Osler, *Thomas Linacre*, pp. 6-7.

[31] With Grocyn, Latimer, and Colet, he translated the extant corpus of Aristotle's works into Latin.

teacher [83] was interrupted by a call to court, where he became Prince Arthur's tutor, and later physician to the king. Upon this latter appointment he took orders because, the Archbishop of Canterbury said, he wanted "to obtain the necessary leisure for his literary work." [84] After a life of great activity—he was busy with his writing, his practice, "and with the organization of the great foundation in London and the benefactions to the two Universities" [85]—he died 20 October 1524.

Osler points out Linacre's special claim upon "us of his profession . . . as one of the most distinguished of the medical humanists." [86] Here he draws rapidly and deftly the picture of the condition of the profession in the early Renaissance, showing the overthrow of Arabian domination and the restoration of the uncorrupted spirit of the ancients, of Hippocrates, Galen, Aristotle, and Plato.[86] Observation and experiment again became "the Alpha and Omega of science," and the part played in this transformation by Linacre is shown by Osler in scholarly fashion by a brief analysis of the effects of Linacre's translations of Galen's *de Sanitate Tuenda* (Reubens's edition, Paris, 1517) (Plate iv), the *Methodus Medendi* (Paris: Matheu, 1519) (Plate v), *de Temperamentis* (Plate vi), *de Naturalibus Facultatibus* (Plate vii), and *de Pulsuum Usu* (Plate viii), all of which were included in collected editions of Galen.

Osler does full justice to Linacre as a grammarian in a chapter on that subject, relating it to his medical work:

> Distinguished physicians have often sought and found honour in fields far remote from the guild, and in literature, and more particularly in science, many have become famous, not a few while still active in practice. . . . So far as we know, Linacre never gave up the pursuit of medicine as a calling, but all through his life the infection of his early studies remained, and in hours of leisure he prepared two works which carried his fame as a grammarian into regions to which the name of the English physician had never penetrated.[87]

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[83] Erasmus and Thomas More were among his pupils.

[84] William Osler, *Thomas Linacre*, pp. 20-21.

[85] *Ibid.*, p. 21.

[86] *Loc. cit.*

[86] Plate III in *Thomas Linacre* is a facsimile of the frontispiece of Champier's *Symphonia Platonis* showing "the four princes of medicine executing a symphony with their violins."

[87] William Osler, *Thomas Linacre*, p. 28.

The history of Linacre's grammars is summarized, and the different works are critically analyzed in a manner that shows Osler's mastery of philological criticism.

The essay ends with a discussion of the Linacre foundations, one of the first attempts to endow university teaching. Throughout the whole, Osler shows a remarkably wide acquaintance with every scrap of information on the man who was "an example of a life of devotion to learning, to medicine and to the interests of humanity." [38] The carefully balanced treatment of the mass of data he had gathered together well illustrates the highly critical basis upon which Osler worked as a historian.

V

From Linacre we may well turn to Osler's treatment of two other early Renaissance figures, Michel Servet [39] and Fracastor.[40] Osler had a full appreciation of the spirit of the time he treated of; there is no better illustration of this than the opening paragraph of *Michael Servetus*:

> The year 1553 saw Europe full of tragedies, and to the earnest student of the Bible it must have seemed as if the days had come for the opening of the second seal spoken of in the Book of Revelation, when peace should be taken from the earth and men should kill one another. One of these tragedies has a mournful interest this year, the four hundredth anniversary of the birth of its chief actor; yet it was but one of thousands of similar cases with which the history of the sixteenth century is stained. On October 27, shortly after twelve o'clock, a procession started from the town-hall of Geneva—the chief

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[38] *Ibid.*, p. 60.

[39] William Osler, *Michael Servetus* (London, 1909). In a footnote to the title Osler says that "This address did double duty—at the Johns Hopkins Medical School Historical Club, and as an Extension lecture in the Summer School, Oxford" p. 3). The paper was read to the Historical Club on 10 May 1909, evidently at that time incomplete, for Cushing says Osler gave most of it impromptu, reading only the opening section (Harvey Cushing, *op. cit.*, II, 174). By September the essay was finished, and was read to the Oxford extension-course students, "some 1600 in number, most of whom it would appear subsequently came to tea" (*ibid.*, II, 187). *Cf.* also William Osler, *Bibliotheca Osleriana*, Nos. 839-896.

[40] William Osler, "Fracastorius," in *An Alabama Student and Other Biographical Essays*, pp. 278-294 (Reprinted from the *Proceedings of the Charaka Club*, vol. II). The paper was read in December 1904 at a meeting of the Charaka Club, composed of New York doctors who were bibliophiles.

magistrates of the city, the clergy in their robes, the Lieutenant Criminel and other officers on horseback, a guard of mounted archers, the citizens, with a motley crowd of followers, and in their midst, with arms bound, in shabby, dirty clothes, walked a man of middle age, whose intellectual face bore the marks of long suffering. [The walk up the hill outside the city is described; the fateful stake, the heaped-up bundle of faggots, the large stack of MSS and a thick printed book tied around the victim's waist, and the piercing cry he gave as the flames flashed in his eyes.] Thus died, in his forty-fourth year, Michael Servetus Villanovanus, physician, physiologist, and heretic. Strange, is it not, that could he have cried, "Jesu, thou Eternal Son of God!" even at this last moment, the chains would have been unwound, the chaplet removed, and the faggots scattered; but he remained faithful unto death to what he believed was the *Truth* as revealed in the Bible.[41]

To paint a picture as vivid, as dramatic, and yet as restrained as this necessitates a complete appreciation of the temper of the mind of the times, which Osler had as a result of extensive readings in early sixteenth century books and manuscripts.

The scene is set in much the same way in the essay on Fracastorius:

Upon few pictures in literature do we dwell with greater pleasure than that of Catullus returning to his home near Verona, wearied with the pleasures of the Capital, sick at heart after the death of his much beloved brother, and still, we may fancy, aching with the pangs of misprized love; but at the sight of "Paeninsularum Sirmio insularumque ocellus," he breaks out into joyful song, and all his cares vanish.

Fifteen centuries later another "Bard of Sirmio" sang the joys of the Lago di Garda, "mid Caphian hills," and while we cannot claim for Fracastor a place beside his immortal townsman, he occupies a distinguished position in our annals as the author of the most successful medical poem ever written, and as the man from whom we date our first accurate knowledge of the processes of infection and contagion.[42]

The same process of placing the "story" in time and space is observable here as in many of Osler's other essays. Also, he manages in each case to sound the keynote of the contents of the essay in these first two or three paragraphs. His principal concern with Servetus will be the heresy of that man, and the psychological make-up which caused him to differ so from the Church as to come finally to the

[41] William Osler, *Michael Servetus*, pp. 3-4.
[42] William Osler, *An Alabama Student and Other Biographical Essays*, p. 278.

stake; Fracastor interests him as one of the very few points of light in the history of medicine in the early Renaissance.

In both these cases, Osler saturated himself with the works of the men in their original editions, reading also the most fruitful secondary sources. In each case he then relates the parts of each man to the whole, giving each its proper proportion. Fracastor comes down to us less as a poet than as a medical observer; thus emphasis will be on the *de Contagione*, upon which rests Fracastor's scientific reputation. " It contains among other things three contributions of the first importance—a clear statement of the problems of contagion and infection, a recognition of typhus fever, and a remarkable pronouncement on the contagiousness of phthisis." [43] Fracastor the poet, sunk now into complete oblivion but for the fact that his poem on syphilis gave the disease its name, is buoyed up by Fracastor the scientific observer.

Osler gives a full account of both the *de Contagione* and the *Syphilis / Sive Morbus Gallicus* (Verona, 1530), which shows a careful critical taste for historical material. A few years before the essay was written, Osler had come upon the idea of the contagiousness of phthisis in Fracastorius, and had sent a notice of it to Lawrason Brown's Saranac journal.[44] This furnished a nucleus for an essay in which the wheat is carefully separated from the chaff—there was an immense pile of chaff—and put into a composite picture of vivid description and interpretation.

The same fine balance appears in Servetus. As an essay in medical history, perhaps the principal thing to know about Servetus is that he discovered the pulmonary circulation of the blood long before Harvey:

> In possession of a fact in physiology of the very first moment, Servetus described it with extraordinary clearness and accuracy. But so little did he think of the discovery, of so trifling importance did it appear in comparison with the great task in hand of restoring Christianity, that he used it simply as an illustration when discussing the nature of the Holy Spirit in his work *Christianismi Restitutio*.[45]

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[43] *Ibid.*, p. 283.
[44] *Cf.* Harvey Cushing, *op. cit.*, I, 646.
[45] William Osler, *Michael Servetus*, p. 24.

But while Osler gives the discovery the space it deserves as being of importance, discussing the state of medicine at the time and the effects of the dominance of Galen's doctrines, he does not forget that perhaps the only part which the discovery played in the life of Servetus himself was to aid in getting him executed. And again, the facts of value to medical history are made of greater value (and of immeasurably greater interest) by the bio-bibliographical method of relating them to the lives of the men.

VI

Shortly after writing the essay on Fracastorius, Osler went to England to take up his duties as Regius Professor at Oxford. It was altogether appropriate that his formal introduction to the English profession should have been made at Guy's Hospital with an address on Sir Thomas Browne's *Religio Medici*. The effects of the *Religio* on Osler's thinking cannot be overstated. So great was his enthusiasm for the work that he gathered together an almost complete collection of all the editions ever printed—some fifty-five in number—which he exhibited at the time he read his essay.[46]

In Browne Osler was studying a great man, an inspiration, rather than one who made contributions to the technical advance of medicine. Here he is more interested in the human side—a doctor of the seventeenth century who wrote his own creed and who strove to follow a scientific and sensibly sceptical path through life. Osler's great reverence for the *Religio* arises out of an early acquaintance with the book and with the man; and he advises others to follow in his footsteps in this regard:

> For the student of medicine the writings of Sir Thomas Browne have a very positive value. The charm of high thoughts clad in beautiful language may win some readers to a love of good literature; but beyond this is a still greater advantage. Like the "Thoughts of Marcus Aurelius" and the *Enchiridion* of Epictetus, the *Religio* is full of counsels of perfection which appeal to the mind of youth, still plastic and unhardened by contact with

[46] William Osler, "Sir Thomas Browne," reprinted from *The Library* (January 1906), in *An Alabama Student and Other Biographical Essays*, pp. 248-277.

the world. Carefully studied, from such books come subtle influences which give stability to character and help to give a man a sane outlook on the complex problems of life. Sealed early of this tribe of authors, a student takes with him, as *compagnons de voyage*, life-long friends whose thoughts become his thoughts and whose ways become his ways. Mastery of self, conscientious devotion to duty, deep human interest in human beings—these best of all lessons you must learn now or never: and these are some of the lessons which may be gleaned from the life and from the writings of Sir Thomas Browne.[47]

Osler, moving in this vein, gives some attention to Browne's reputation since his death, briefly mentioning critical writings from Samuel Johnson to Walter Pater and their estimate of one whom Taine calls "a naturalist, a philosopher, a scholar, a physician, and a moralist" and whom Lowell speaks of as "our most imaginative mind since Shakespeare." [48] He compares Browne with others of his profession, decides he is not of Harvey's rank as a scientific man, and apologizes for his belief in witches—"a man must be judged by his times and his surroundings" [49]—in view of the valuable efforts he made to dispel popular superstitions by the scientific methods reported in the *Pseudodoxia Epidemica*.

If the Thomas Browne essay is to be considered purely as a historical essay, this critical section on Browne's place as a physician is far too short. But this is one of those addresses in which Sir William gave as important a place to bibliographical and inspirational material as to that of history, again illustrating a thoroughly balanced viewpoint. In *Sir Thomas Browne* Osler is trying to hand on to students of the next generation a sense of the inspiration he himself has got from the works of that man.

The essay on John Locke [50] is rather a departure from this method of treatment. In Locke Osler is handling a man whose philosophical works are widely read, whose fame as a philosopher has increased

[47] *Ibid.*, pp. 276-277. [48] Quoted *ibid.*, p. 272. [49] *Ibid.*, p. 276.

[50] William Osler, "John Locke as a Physician," reprinted from *The Lancet* (20 October 1900) in *An Alabama Student and Other Biographical Essays*, pp. 68-107. First read to the Students' Societies of the Medical Department of the University of Pennsylvania, 16 January 1900. It was also used in an address at McCoy Hall, Baltimore, 28 October 1904, the two-hundredth anniversary of Locke's death.

through the years, but whose medical studies and work have been largely forgotten. Osler came upon the material for this essay while "hunting and grubbing in the British Museum and Record Office"[51] during the summer of 1899. He was that summer examining the Shaftesbury papers for material on Sydenham when he came upon Locke's medical records. Locke was Sydenham's pupil, and the master's annotations and comments, written in his own hand on some of Locke's writings, give evidence of the strong friendship between the two, a twenty-year friendship which ended only with Sydenham's death.

Osler's particular purpose in this essay is to examine the new material he has turned up on Locke as a physician, but he first places the man's work in its proper relation to his life as a whole. This done, he goes on to say:

> No single circumstance better illustrates John Locke as a physician than the elaborate details which he has left on record of his most celebrated patient, the first Lord Shaftesbury. This remarkable man is satirized by Dryden in the well-known lines:
>
> "Of these the false Achitophel was first;
> A name to all succeeding ages curst:
> For close designs and crooked counsels fit;
> Sagacious, bold, and turbulent of wit;
> Restless, unfix'd in principles and place;
> In power unpleas'd, impatient of disgrace:
> A fiery soul, which, working out its way,
> Fretted the pigmy body to decay,
> And o'er-inform'd the tenement of clay."[52]

The "o'er-inform'd tenement of clay" refers to Shaftesbury's ailment, hydatids of the liver, the discharge from which Locke had tapped with a silver tube.

In the Record Office Osler found four transcripts of the case, all in Locke's handwriting,[53] and he reproduces long extracts from them which is some cases are his own translations from Locke's Latin.[54]

[51] As he wrote to Musser. Quoted in Harvey Cushing, *op. cit.*, I, 513.
[52] William Osler, *An Alabama Student and Other Biographical Essays*, p. 80.
[53] *Ibid.*, p. 82.
[54] *Ibid.*, pp. 82-95.

Osler himself follows the descriptions given of the progress of the disease with a careful diagnosis of his own in the light of modern medicine, arriving at the conclusion:

> From the long-standing character of the tumour and the character of the material which escaped—the innumeral bags—there can be no doubt that the disease was hydatids of the liver, which, remaining quiescent from 1656, had, as is so often the case, suppurated. It is one of the first instances on record in which the abscess was opened.[55]

And, characteristically, after viewing the case from a medical angle, Osler then takes it up from a human one, observing and quoting from the various satires of the day. The "tap" became famous, and was used to advantage by such political satirists as Dryden and Carryl.[56]

The other of Locke's cases which Osler discusses in some detail is the *tic douloureux* in Lady Northumberland, on which he gives brief abstracts from the descriptions in Locke's letters to Dr. John Mapletoft.[57] Also taken up are Locke's medical essays, consisting of a few fragmentary papers, "the chief interest of which to-day is that they are from the pen of the great philosopher."[58] These are

[55] *Ibid.*, p. 89. Osler goes on here to say that, "Naturally, from the prominent position of the patient and the strange character of the disease, the case attracted unusual attention." Locke assisted Lord Shaftesbury in getting up a questionnaire which he sent around among the faculty of medicine to determine whether the wound should be healed as soon as possible or the tube be left in place. Osler reproduces the questionnaire, together with Locke's and Sydenham's answer to it (*ibid.*, pp. 89-94); Osler says that among the Shaftesbury papers there are answers to this questionnaire from Locke, Sydenham, Glisson, Sir George Ent, Micklethwaite, Timothy Clark, and the Abbé Beaupreau of Angers: of these, only Clark recommended that the wound be closed (*ibid.*, p. 90).

[56] *Ibid.*, p. 95. "Duke, an imitator of Dryden, describes him under the name 'Antonius' in his lines—

> The working ferment of his active mind
> In his weak body's cask with pain confined
> Would burst the rotten vessel where 'tis bent
> But that 'tis tapt to give the treason vent."

And in *The Hypocite* Carryl rhymes (?) thus:

> "The silver pipe is no sufficient drain
> For the corruption of this little man."

[57] *Ibid.*, pp. 96-98.

[58] *Ibid.*, p. 98.

the *Ars Medica*, or *De Arte Medica*, an introduction to a treatise on the philosophy of medicine; *Anatomia*, a longer paper in which Locke "contends 'that nature performs all her operations in the body by parts so minute and insensible that I think nobody will ever hope or pretend even by the assistance of glasses or other inventions to come to a sight of them;'"[59] *Respirationis Usus; Tussis*, an essay on coughs; and a dedication and preface to a proposed work on small-pox by Sydenham, neither of which were ever used.

All this material is fitted carefully into its proportionate place in Locke's life. Osler does not forget that Locke's main business was philosophizing; but he wishes to remind us that Locke *was* a physician, and that the pursuit of his profession had a great influence on his life. He was much in the company of the physicians of the time, an extremely intimate friend of Sydenham, and a close friend and admirer of Mapletoft. "Evidently," says Osler—

> Locke's clear, strong judgement was valued by his friends in all relations of life, and as Somers and other politicians turned to him for instruction in questions of trade and finance, so his friends and others insisted upon utilizing his medical knowledge.[60]

And he closes on a strong philosophical touch which plants the readers' feet firmly on the ground and points out a clear historical perspective:

> For each one of us there is still a "touch divine" in the life and writings of John Locke. A singularly attractive personality, with a sweet reasonableness of temper and a charming freedom from flaws and defects of character, he is an author whom we like at the first acquaintance, and soon love as a friend. Perhaps the greatest, certainly, as Professor Fowler says, the most characteristic, English philosopher, we may claim Dr. Locke as a bright ornament of our profession, not so much for what he did in it, as for the methods which he inculcated and the influence which he exercised upon the English Hippocrates. He has a higher claim as a really great benefactor of humanity, one of the few who "reflected the human spirit always on the nobler side."[61]

Material as well-oriented and impartially evaluated as this is of great value to the medical and social historian.

[59] *Ibid.*, p. 99. [60] *Ibid.*, p. 106. [61] *Ibid.*, pp. 106-107.

VII

I have considered here only those essays which best illustrate Osler's historical perspective, an instrument used best only on subjects which lend themselves easily. There are more than one hundred essays from Osler's pen of a biographical or historical nature,[67] and it is obviously impossible to go into all of these in careful detail. Many make fully as delightful reading as those reviewed, and there are some that show Osler in a highly literary light.[68]

As has been pointed out, Osler sought always to make his subjects live, to make them human again after the *rigor mortis* of immortality had set in, or to raise and give life to a wholly forgotten form. Only a man with eminently human sympathies and a well grounded sanity could do this; otherwise the result would be mere debunking. Osler will not show Servetus as a self-sacrificing, senseless martyr, but instead shows him as a man of sound common sense gone a little astray on a fanatic path—precisely the judgment anyone would pass upon him if he were a contemporary instead of an ancient. Likewise, he will not picture Keats as a long-haired, melancholy poet. He drags out from Keats's letters an old medical joke well worth the telling, which shows one of the few incidents that give any indication whatever (in either Keats's poems or his letters) of the poet's professional training:

[67] Osler's work in direct medical history has already been commented upon. It is safe to say that he studied and wrote about every major figure in the history of medicine, and many minor ones as well. His Harveian essay is a little masterpiece of human judgment (*cf. An Alabama Student and Other Biographical Essays*, pp. 295-334); the essays on Alfred Stillé (*ibid.*, pp. 232-247) and William Pepper (*ibid.*, pp. 211-231) are fine tributes to great teachers, and valuable contributions to the literature of medical history; the "Men and Books" pages in the *Canadian Medical Association Journal*, vols. II, III, and IV (1912, 1913, 1914), twenty-six papers on a wide range of subjects, show an enormous depth and breadth of knowledge. *Cf.* the complete bibliography compiled by Dr. Maude Abbott and others (Section IV, pp. 560-575) in the Osler Memorial Number of *Bulletin No. IX of the International Association of Medical Museums* (Montreal, 1926).

[68] Besides the Linacre, Browne, Locke, and Holmes essays mentioned above, in this connection also should be listed the essay on Thomas Dover (*An Alabama Student and Other Biographical Essays*, pp. 19-36) and John Keats (*ibid.*, pp. 37-54).

He played a medical prank on his friend Brown, who had let his house to a man named Nathan Benjamin. The water which furnished the house was in a tank lined with lime, which impregnated the water unpleasantly. Keats wrote the following short note to Brown:

"*Sir*,—By drinking your damn'd tank water I have got the gravel. What reparation can you make to me and my family?

NATHAN BENJAMIN."

Brown accordingly surprised his tenant with the following answer:

"*Sir*,—I cannot offer you any remuneration until your gravel shall have formed itself into a stone, when I will cut you with pleasure.

C. BROWN." [64]

This is the sort of human reconstruction which a poet of Keats's fame can well stand. That Osler could read through the letters, several lives, and the poems in search of material bearing on Keats's medical education, and come away with a view neither medical nor poetic but fully rounded is a tribute to the accuracy and warm-bloodedness of his historical perceptions.

It should be marked that Osler, besides taking extant material and moulding it into a picture that would make it useful to others in the field of medical history, turned up a good deal of original material for himself. One reviewer says:

In nearly all the essays, there is abundant evidence of research, of the hunt for original sources (almost too briefly recorded for the benefit of the reader), and the careful use of them, but there is no musty odor, no rattling of dry bones, whether Osler goes back thirty or three hundred years. The reader feels that the author thoroughly understands the men of whom he writes and to an unusual degree is able to think their thoughts and appreciate their difficulties, so that biographical data are no longer mere dates and chronicles, but become living things, human experiences intelligible and appealing.[65]

And another is somewhat surprised:

As for Locke, we admit that nearly all Dr. Osler says is new to us. Locke was also a serious doctor, and a deep thinker in his profession.[66]

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[64] *Ibid.*, pp. 47-48.

[65] Unsigned review of *An Alabama Student and Other Biographical Essays*, *The Nation*, LXXXVII (3 December 1908), 555-556.

[66] "Dr. Osler's Biographies," *The Spectator*, CI (3 October 1908), 503.

In his biographical studies Osler has done a service to all mankind in turning the light of his vast knowledge on those subjects which most needed this particular type of illumination. He has furnished a necessary link in the transmission of culture, and in its transmutation, too. "What then," says John Ferguson in the *Bibliotheca Chemica*, which Osler was fond of quoting—"What then do these men not owe to him who gathers up their works, and in so doing recalls their achievements, and thus labours to lift that icy pall of oblivion which descends upon everything human. . . ."

Fig. 1.

FERDINAND COHN.

BACTERIA

The Smallest of Living Organisms

By

DR. FERDINAND COHN (1872)

Translated by Charles S. Dolley (1881)

Introduction by Morris C. Leikind

When Ferdinand Cohn published his essay in 1872 entitled, "Über die Bacterien, die Kleinsten Lebenden Wesen," [1] Koch was still an unknown physician. Pasteur was in the midst of his brilliant if somewhat erratic studies on fermentations and spontaneous generation and Lister had only just begun the development of antiseptic surgery. There is an impression current among present day students of bacteriology that the real beginning of their science dates from 1876, when Koch published his now classic paper on Anthrax. This paper is without question a milestone but it is historically incorrect to confuse a milestone with a starting point. Bacteriology was already 200 years old in 1876 and the history of that period explains much of what occurred after the beginning of its third century. It is, I believe, not too strong a statement to say that Pasteur and Koch were actually riding the crest of a tidal wave. A basis for such an opinion will be found in this paper by Cohn which it is my privilege to introduce. This essay on "The Bacteria" is a brief but comprehensive outline of the early history of the study of microbes. In masterly fashion the author sketches the development of our knowledge from the day when the immortal Leeuwenhoek first saw his "little animals," until his own time. We have here a brilliant summary of the position of bacteriological studies as they were considered just before Koch opened what has been called by some historians the Golden Age of Bacteriology. The History of Bacteriology has been written largely by medical men and the emphasis on the rôle of the bacteria as agents of disease has caused their impor-

[1] Sammlung Gemeinverständlicher Wissenschaftlicher Vorträge, Berlin, 1872, Vol. 7, Heft 165, 35 p.

tance in the life cycle to be forgotten. For this reason Cohn's paper is of importance since no one before or after him has so brilliantly and clearly indicated the position of the bacteria in the general economy of nature.

Ferdinand Cohn, one of the greatest of the early bacteriologists, has not yet been accorded his rightful place in the history of bacteriology. Many men have been acclaimed as the founders of bacteriology but even a cursory glance at the history of this science will indicate the practical impossibility of assigning to any one man a position of preëminence. Bacteriology as we know it is the result of the labors of many minds and hands and the historical background has yet to be treated adequately. In a longer and more extensive work now in preparation, I propose to consider in detail Cohn's bacteriological work.

I will therefore confine myself now to a very brief sketch of Cohn's life so as to provide for the reader some background for an appreciation of this paper.

Ferdinand Julius Cohn, the eldest of three brothers, was born of Jewish parents in Breslau on the 24th of January, 1828; the same year in which Wöhler bridged the gap between the organic and inorganic worlds by synthesising urea. Cohn was a precocious child and early displayed that brilliance which marked him as a scholar. At the age of seven, his childhood education completed, he entered the Gymnasium of St. Maria Magdalena. Excelling in all his studies he showed a decided bent for science, especially botany.

Cohn began his university studies at Breslau but did not complete them there. Jews were not admitted to the doctor's degree by the University in his native city and so in 1846 Ferdinand went to the then more liberal University of Berlin. Here he studied with Mitscherlich the mineralogist, Johannes Müller the physiologist, and Ehrenberg who turned Cohn's attention to the fascinating world revealed by the microscope. In 1847 Cohn returned to Breslau and spent the rest of his life there.

Cohn grew up at a time when all Europe was in a ferment. The Industrial Revolution was changing the economic and social status of large masses of the population. The revolutions of 1848 occurred as Ferdinand reached his maturity. An extract from his day book

gives a picture of the young man and his attitude toward events and his work:

Dienstag, den 25. September 1849

Was nachher geschah—es ist viel und wenig. Deutschland todt, Frankreich todt, Italien todt, Ungarn todt—Freiheit, Einheit, Gleichheit todt, Glaube, Liebe, Hoffnung todt,—und die Cholera und die Standgerichte unsterblich.

Ich aus der unfreundlichen Welt da drauszen in mich zurückgezogen, in meine Bücher und Studien vergraben; Wenige sehend, viel lernend, nur noch von der Natur begeistert, viele Pläne fassend, einzelne vorbereitend, keinen vollendend. Mit Göppert, Franzius, Czermak, Milde, Beinling, Friedmann, Berger, Chwolson in freundlichen oder vertrauten Verhältnissen. Den ganzen Tag—mit Ausnahme einer kleinen Reise—am Mikroskop; des Abends auf der Promenade und nur beim Conditor Zerstreuung Suchend, an dem, was draussen vorgeht, kaum Notiz, aber nicht das geringste Interesse nehmend. Das sind Fünf Monate meines Lebens.[2]

In the light of present events one is tempted to describe the first paragraph of this extract as prophetic.

When Cohn began his life work at Breslau it was to the same university that he returned, which had refused to grant him the doctor's degree. But even then the road of a Jew was not smooth. When Cohn finally attained to the professorship, he had the title 20 years before the university gave him the laboratory facilities which accompanied the title. Cohn already had a scientific reputation when he arrived in Breslau. He had recognized in Berlin that further advances in his chosen field of botany must come from the laboratory. Accordingly, his inaugural address [3] in Breslau was a plea for an Institute of Plant Physiology. A similar Institute for Animal Physiology was already being organized for his colleague Purkinje. A score of years passed before Cohn had his institute. When established it became a model for similar laboratories elsewhere.

But Cohn was not idle in the face of difficulties. Finding no microscope available to him, he prevailed upon his father to buy him one. An instrument made by Plossl of Vienna (the finest of the times) was obtained for the then exorbitant sum of 312 florins. Compared to those of today it was a huge affair, the tube being 24

[2] Cohn, Pauline: *Ferdinand Cohn, Blätter der Erinnerung.* Breslau, 1901, 2nd ed., 266 pp.

[3] "Laboratoria phytophysiologica in hortis botanicis instituenda censeo."

inches long and it was impossible to use it from a sitting position. A day at the microscope in those days must have been an ordeal indeed. Cohn recognized the difficulties inherent in those clumsy instruments and wrote:

> so long as the makers of microscopes do not place at our disposal much higher powers, and, as far as possible, without immersion, we will find ourselves in the domain of the bacteria, in the situation of a traveller who wanders in an unknown country at the hour of twilight at the moment when the light of day no longer suffices to enable him clearly to distinguish objects, and when he is conscious that, notwithstanding all his precautions, he is liable to lose his way.

When we recognize therefore the difficulties under which he worked our admiration for his achievements increases.

Cohn early displayed his versatility as an all round naturalist and there is scarcely a subject which he touched that he did not enrich. The bibliography accompanying this paper, listing Cohn's scientific writings enables the reader to grasp the range of his genius. He studied such matters as torsion in trees, the effects of lightning, the nature of waterspouts, the physiology of seeds (his doctoral dissertation treats of this subject), the formation of travertin, the protein crystals in the potato, which he discovered, the rotatoria, luminous worms, etc.

It is with Cohn's bacteriological researches, however, that we are concerned here and these can now only be indicated; a more critical and searching analysis will come later. Chief among his contributions are his system of classification, his discovery of spores which was published in 1876, and the bearing of the knowledge of spores on the problem of spontaneous generation. Cohn's studies on bacteria began with his recognition of their plant nature. Beginning in 1851 his systematic studies for well over twenty years were largely responsible for bringing order out of the chaos which characterized the new knowledge of bacteria and their rôle in nature. Cohn's classical "Untersuchungen über Bacterien," published in 1872, may be considered as the starting-point of modern bacteriology. In this paper he raised again the fundamental question of whether bacteria can be arranged in genera and species. From his accurate morphological studies he concluded that such classification was possible but

he clearly pointed out that morphology alone was an insufficient criterion. He recognized that organisms of similar form can and do differ from each other in their physiological characteristics and in their products. Cohn was unable with the means at his disposal to settle the problem of natural genera and species among the microbes but his student Schroeter [4] took a fundamental first step toward the solution of this problem. In studying chromogenic bacteria, Joseph Schroeter grew organisms on solid substrates such as potato, coagulated egg white, meat and bread. He obtained growths of various colors, red, blue, green, orange and violet. Often there was a spot or colony of one color. Organisms comprising this colony were morphologically alike. If these forms were transplanted from such a single colony to fresh media, organisms of the same type developed into a colony which had the same color as that of the parent. Schroeter had here the secret of pure culture technique but he was unable to realize the full fruits of this. It remained for Robert Koch to perfect, a few years later the methods we now know. Cohn recognized the importance of this discovery and his concept of species and his system of classification is based largely on it. In 1876 Cohn published his studies on the bacterial spore and its relation to the problem of spontaneous generation. His studies on the heat resistance of spores, made simultaneously with, but independently of, those of Tyndall in England, contributed perhaps more than the studies of Pasteur to the final overthrow of the doctrine of spontaneous generation as far as it referred to visible microorganisms.

As a result of his work Cohn was recognized as the foremost student of bacteria of his day and it was only natural therefore that Robert Koch, then (1876) an unknown country doctor, should turn to the great professor at Breslau to demonstrate his discovery of the life history of the anthrax bacillus. The historic demonstration began on April 30, 1876, and lasted for three days. Koch completely convinced his audience of his discovery and Cohn's enthusiasm was boundless. Perhaps the finest picture of Cohn the man may be derived from the story of his generous treatment of Koch. He not only published the epochal paper (for which he helped prepare the plate)

[4] Beiträge Zur Biologie der Pflanzen, 1872, I. Heft 2, p. 109-26.

but was instrumental in obtaining for Koch the post in Berlin where he did his most important work. It may truly be said that Cohn tilled the soil in which Koch's genius came to flower.

But enough has now been said to indicate Cohn's outstanding position as one of the founders of the science of Bacteriology. To extend this introduction would be to lose the picture in its frame. Suffice to note in conclusion that Cohn was as brilliant a teacher and writer as he was an investigator. His work was recognized during his lifetime by election to foreign membership in the Royal Society. In 1895 he was awarded the Gold Medal of the Linnean Society. When Ferdinand Cohn died suddenly on the 25th of June, 1898, he had lived through one of the most fruitful periods in the history of science.

The Translator

Cohn's paper, aside from its intrinsic interest, has an additional importance to students of the history of American bacteriology. This paper was one of the earliest works to be translated into English in this country on the subject of bacteriology and thus the new knowledge developing across the Atlantic was made available to Americans. We are indebted for this translation to Charles S. Dolley. While yet a medical student at the University of Pennsylvania he read Cohn's paper and recognized its importance and in 1881 he published his translation.* When I discovered this rendition I became interested in the translator and looked for information concerning him. I was fortunate enough to learn that Dr. Dolley is now living in Nassau in the British West Indies and a letter dispatched to him in November 1937 brought a prompt reply which included his gracious permission to reprint the paper now before us. A few facts about his life may be of interest.

Charles Sumner Dolley was born on June 16, 1856, in Elyria, Lorraine County, Ohio. After preliminary education at Rochester, New York (his parents were both physicians and had come to Rochester from Ohio), Dolley became in 1873 an assistant to Joseph Leidy, then with the U. S. Geological Survey in Wyoming Terri-

* [Except for the correction of some misspelled names no changes have been made in the text—M. C. L.]

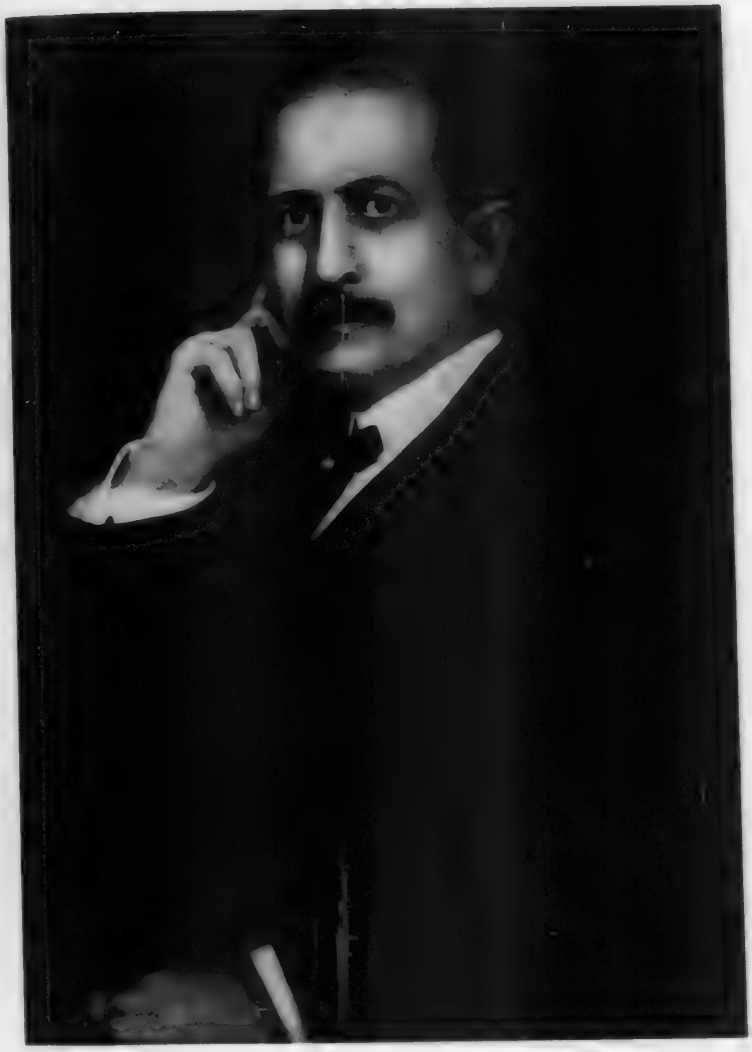

Fig. 2.

CHARLES S. DOLLEY

tory. In 1874 he entered Syracuse University where he specialized in natural science. After spending time abroad with Leidy he finally completed his collegiate studies and in 1880 pursued courses in the Medical Department of the University of Pennsylvania. He graduated as Doctor of Medicine in 1882. In 1883 he entered the Johns Hopkins University Department of Biology for advanced studies in morphology under Prof. W. K. Brooks. In 1884 after completing his studies at the Hopkins he went abroad once more on a travelling fellowship awarded by the University of Pennsylvania. He spent part of his time at Leipzig where he studied bacteriology with Weigert. He completed his year at the Naples Zoological Station. While there he wrote his "Technology of Bacteria Investigations."[5] This book, now almost unknown to bacteriologists, was one of the earliest American texts on the subject. It gave detailed directions for studying bacteria and each section was very well documented. To those interested in the history of bacteriology Dolley's book is of great interest because of its wealth of references to the early technical developments.

In 1885 Dolley returned to America and joined the faculties of Swarthmore College and the University of Pennsylvania. He immediately organized courses in biology and introduced instruction in Bacteriology. A copy of the laboratory guide used in his classes at the University of Pennsylvania is in the Welch Medical Library. Ten pages of this guide are devoted to directions for studying the bacteria. By a curious oversight MacFarland in his admirable study of the beginnings of bacteriology in Philadelphia [6] neglects to mention the pioneer work of Dolley at the School of Biology of the University of Pennsylvania. According to MacFarland "the period of the beginning of bacteriology in Philadelphia . . . is to be found in the decade from 1890 to 1900." This may be true for the study of bacteriology in the medical school but as a university subject and

[5] Dolley, Charles S. The Technology of bacteria investigation; explicit directions for the study of bacteria, their culture, staining, mounting, etc., according to the methods employed by the most eminent investigators. Boston, S. E. Cassino & Co., 1885, 263 pp.

[6] Beginning of Bacteriology in Philadelphia, *Bulletin of the Institute of the History of Medicine*, 1937, Vol. 5, pp. 149-198.

branch of biology, bacteriology was being taught as early as 1885. In this connection it is interesting to note that even other university departments were cognizant of the new developments in science because we find that in 1889 Cohn's [7] paper in the original language was used in the German classes of the University of Pennsylvania as one of the texts.

Dolley after a brilliant teaching career in Philadelphia relinquished his classes to devote himself to technical research in the fields of industrial biology and chemistry. As this is written he is on a tour of South America.

[7] Über bacterien; die kleinsten lebenden wesen, von dr. Ferdinand Cohn . . . with notes for American students by Oswald Seidensticker . . . New York, H. Holt & Co. 47 p. illus. (German scientific monographs for American students.)

Ueber Bacterien,

die kleinſten lebenden Weſen.

Von

Dr. Ferdinand Cohn,
Profeſſor an der Univerſität zu Breslau.

Mit Holzſchnitten.

Berlin, 1872.
E. G. Lüderitz'ſche Verlagsbuchhandlung.
Carl Habel.

Title-page of original edition.

Fig. 3.

BACTERIA:

THE

SMALLEST OF LIVING ORGANISMS

BY

DR. FERDINAND COHN,
PROFESSOR IN THE UNIVERSITY OF BRESLAU.

TRANSLATED BY

CHARLES S. DOLLEY,
STUDENT IN THE MED. DEP'T OF THE UNIVERSITY OF PENN.

ROCHESTER, N. Y.
—
1881.

PREFACE BY TRANSLATOR.

Why scientific and medical books, above all others, should not be published in cheap editions in this country, as they are abroad, is a query that has occurred to me at various times since the beginning of my medical studies. With all our great publishing houses, I have yet to find the one that furnishes the student with scientific books at low prices. The popular demand is well supplied, but the German or French student has an advantage over the American, in that he has at his command low priced, usually paper cover, editions of all the best writings in medicine and science.

I have deemed no excuse necessary for offering to American students the present paper on a subject of so much importance, and by so eminent a writer, of whom Dr. Antoine Magnin says in his recent excellent work: " M. Cohn is the naturalist who, in our days, has occupied himself the most with the bacteria." Not having been accustomed to translate for publication, I would ask forbearance for the imperfections that may be found in the following pages. The figures in the appended lithographic plate were all drawn by Dr. Cohn for the *Microscopical Journal*, and it was preferred, on account of the greater number of forms depicted, to the one originally accompanying this article. In a few places, since writing which the author has had reason to change his views, I have endeavored to bring to bear the facts as known up to date, by means of notes, for which purpose I have had recourse principally to Dr. Sternberg's admirable translation of Magnin's work referred to above, and to which I would direct all who may desire to enter upon a more extended study of these " of all beings the most widely diffused."

C. S. D.

ROCHESTER, N. Y., *August* 9, 1881.

BACTERIA.

In the year 1875 science celebrated the second centennial of the discovery of a new world by Anton Leeuwenhoek, who while without classic education, was gifted with a strong desire for investigation; the seventeenth century, the age of the greatest discoveries in natural science, animated him as well as many other gifted minds.

Leeuwenhoek had early in his youth left the merchant's shop in Amsterdam, which he had entered as an apprentice, and contented himself with the position of janitor of the court room in his native Delft, where he served thirty-nine years; but his spare time and his great mechanical talent he applied to the manufacture of magnifying glasses, with which he, commencing as an amateur, observed gnat wings, bee stings, butterfly scales and mosses.

But the previously unattained perfection of his microscope, and his clear and persevering gift of observation, soon revealed to him "deep secrets of nature," * which he communicated to the Royal Society of Sciences in London in enthusiastic letters. In April, 1675, Leeuwenhoek placed beneath his microscope a glass tube full of standing rain water, and with astonished surprise he noticed in the water wonderful forms,—little bells which expanded and contracted themselves, with little globules which shot quickly here and there. At first he thought he saw the living atoms which, according to the philosophy of Democritus, composed all bodies, and from whose whirling motion his contemporary, Descartes, believed the world built itself anew. But Leeuwenhoek soon became satisfied that these were animalcules, invisible to the naked eye, but which in varied forms animated the drop of water. Other animal and plant forms were found later in great abundance, in infusions of pepper, hay and other animal and vegetal materials, and for that reason were named *Infusoria*. Exactly a century after Leeuwenhoek, Müller, an investigator in Denmark, having devoted twelve years of his life to the observation of these smallest of creatures, found, named and

* Leeuwenhoek, *Arcana naturæ detecta.*

described about three hundred and eighty different forms in the fresh and salt waters of Copenhagen.*

In the next century the number of observers increased rapidly, who, with still more perfect instruments, sought to penetrate into the unseen world. Aside from the numerous animal race, a very peculiar microscopic flora was discovered, the appearance and development of which differed entirely from that of visible plants. If Leeuwenhoek was the Columbus of this new world, we may designate Ehrenberg the Humboldt of the same, for from the year 1829 up to the present day Ehrenberg has, with indefatigable diligence, thoroughly investigated these hidden provinces to the outermost boundaries; and not only described, delineated and classified the microscopical beings more thoroughly and more truly than his predecessors, but also unveiled the unsuspected importance which was due to creatures of the invisible world, in the entire natural arrangement, not only in the present, but in former geological ages.

Every one knows in how many relatively different sizes the life of the visible world embodies itself. The mites belong to the smallest creatures visible to the naked eye. They are found in numberless swarms in cheese, and in fruits rich in sugar. Their size compares to that of man about as a sparrow to the Strasburg Cathedral. A similar comparison may be made between the giant fir tree, and the moss which grows on its bark. Of the little animalcules that Leeuwenhoek discovered, he stated that their size compared with the mite as the bee with the horse. The more the microscope has been improved, and its magnifying power increased, the smaller have been the beings that became accessible to keen observation, since among the animals and plants of the unseen world, a difference in size is found, similar to that between the herring and the whale.

But the smaller the organism, the simpler appears to be its form, the more imperfect its life energy, and the lower its place in the rank of created beings. Among the animals of the microscopic world, we find exceedingly few that possess the fullness of organs of an insect, a crab, or even of a worm: the true infusoria stand on the lowest step of the animal kingdom. Even so we find among micro-

*O. F. Muller, *Vermium terrestrium et fluviatilium historia.*

scopic plants not one that reaches the developed form of the blooming plant, or belongs to even the lowest class of the ferns; only the lowest plant forms, which we usually designate as algæ and fungi, form the forests and meadows of the invisible world.

But the more the inner formation of microscopic organisms is simplified, the fewer appear to be the characteristics which so easily separate plants and animals in the visible world. The infusoria are wanting in muscle and nerve, while vessels and breathing organs are very imperfectly developed. On the other hand microscopic plants show independent movement, and even organs of movement, such as we are only accustomed to find in animals. In the very lowest organisms animals and plants appear to run into each other, and the naturalist is in doubt to which of the two kingdoms he shall assign the subject of his investigations.

But the smallest, and at the same time the simplest and lowest of all living forms, we call *Bacteria.** They form the boundary line of life; beyond them life does not exist, so far at least as our present microscopic expedients reach; and these are not small. The strongest of our magnifying lenses, the immersion system of Hartnack, gives a magnifying power of from 3000 to 4000 diameters; and could we view a man under such a lens, he would appear as large as Mont Blanc, or even Chimborazo. But even under this colossal amplification the smallest bacteria do not appear larger than the points and commas of good print. Of their internal parts little or nothing is to be distinguished, and even their existence would for the most part remain hidden, did they not live in such gregarious masses.† These smallest bacteria may be compared with man about as a grain of sand to Mont Blanc.

If it is important on their own account to learn to know these smallest and at the same time simplest of organisms, then will our interest be increased through the knowledge that just these little

* From βακτήριον, a little staff or rod.

† "So long as the makers of microscopes do not place at our disposal much higher powers, and, as far as possible, without immersion, we will find ourselves, in the domain of the bacteria, in the situation of a traveler who wanders in an unknown country at the hour of twilight, at the moment when the light of day no longer suffices to enable him clearly to distinguish objects, and when he is conscious that, notwithstanding all his precautions, he is liable to lose his way."—COHN.

forms are of the very greatest moment; since they, with invisible, yet irresistible power, govern the most important processes of animate and inanimate nature; and even seize on the being of man secretly, but at the same time fatally.

The forms of the bacteria resemble sometimes balls or eggs, sometimes shorter or longer rods or fibres, and sometimes corkscrews or screws. The bodies consist of an almost colorless albuminous substance, in which numerous shining, fatty granules are embedded,* and which is inclosed in a thin membrane (cellulose), insoluble in caustic potash. According to their form, we can distinguish ball, rod, fibre and screw bacteria.

They are divided by scientists into genera and species. The author of this paper has in his new work recognized six genera, as follows:

1.	*Micrococcus*,	ball or egg-shaped bacteria,	figs.	1 to 7.
2.	*Bacterium*,	short rod-like	" "	8 to 12.
3.	*Bacillus*,	straight, fibre-like	" "	14, 15.
4.	*Vibrio*,	wavy, curl-like	" "	16 to 18.
5.	*Spirillum*,	short, screw-like	" "	19 to 21.
6.	*Spirochaete*,	long, flexible, spiral	" "	22.

Nearly all bacteria possess two different modes of life, one of motion and another of rest. In certain conditions they are excessively mobile, and when they swarm in a drop of water, moving amongst each other in all directions, they present an attractive spectacle, similar to that of a swarm of gnats or an ant-hill. The bacteria swim rapidly forward, then, without turning about, retreat; or even describe circular lines. At one time they advance with a rocket-like spring, at another they turn upon themselves like a top; or they remain motionless for a long time, in order as quick as lightning to be up and away. The longer, fibre-like bacteria bend their bodies in swimming, sometimes sluggishly, sometimes with address and agility, as if they were troubled to find their way through some impediment,

* Some of these granules have recently been found to consist of crystalline sulphur (CRAMER, COHN). They have been observed in *Monas Okenii*, *Bacterium Sulphuratum*, and in the different species of *Beggiatoa*, which latter are found most abundantly in thermal sulphur waters, where they play a great *rôle* in the elimination of sulphur, and the disengagement of sulphuretted hydrogen (MAGNIN).

like a fish that seeks its way among aquatic plants. Sometimes the little fibre stands still a long time, as though it would rest; then suddenly it begins to tremble, and swims back, in order soon to steer forward again. All these movements are accompanied by a rapid turning on the axis, like a screw moving in the screw nut; this becomes especially apparant if the little rods are bent, when they appear to be giddily whirling around. When the wavy formed vibrios and the screw formed spirilla turn themselves quickly on their axes, they give rise to a curious delusion, as if they possessed an eel-like motion, although they are in reality perfectly rigid. They often, meteor-like, dart here and there through the water, so that the observer is scarcely conscious of their presence, or they roll rapidly through the field of vision; sometimes they fasten themselves by one end, and move the other end in a circle exactly like a sling around the cord; soon after, one sees them winding slowly through the water.

Nearly all the older observers regarded bacteria as animals, since their movements were considered to be voluntary.† Certainly it is inner life energy which causes the movements of the bacteria, and the power of movement is even more enigmatical, since no organs of motion are visible,* yet no doubt the appearance of volition is

* Bacteria were regarded as animals up to the time of Dujardin (1841), a kingdom—the *Protista*—midway between the animal and vegetable, being created by Haeckel for their especial benefit. Davaine (1859) was however among the first to show clearly their alliance with the algæ. Cohn holds them to belong to the algæ, although, from their want of chlorophyll, approaching the fungi. Magnin says: "If there are still some differences of opinion among naturalists as to the place of the bacteria among the cryptogams, there is but one opinion as to their vegetable nature. Sachs, however, solves the question by uniting the algæ and fungi in a single group, the *thallophytes*, in which he establishes two series exactly parallel—one comprising the forms with chlorophyll, the other the forms which are deprived of it."

To quote our author again: "The bacteria, then, resemble green plants, in that they assimilate nitrogen contained in their cells by taking it from ammonia compounds, which animals cannot do. They differ from green plants, in that they cannot draw their carbon from carbonic acid, and only assimilate organic substances containing carbon, above all the hydrates of carbon and their derivatives; and in this respect they resemble animals."

† Ehrenberg was the first to maintain that the motion of bacteria depended upon the presence of vibratile cilia (observed by him in *spirillum volutans*); "but, although the cilia, denied at first by most microscopists, have been seen since in nearly all the bacteria, recent researches permit us to say that cilia exist without

only a delusion. No mind energies, as they lie in our conception of volition, and which in fact govern the least of the actions of higher animals, are in play in the bacteria.

Exactly similar movements, as has been already remarked, are noticed in many microscopic plants, either continuing, as in the diatom and oscillaria, or transient during propagation, as the zoöspores or little seed-bodies of the algæ and fungi.

The collective development of the bacteria makes it in the highest degree probable that they belong to the vegetable kingdom, and in the nearest relation to the *Oscillariæ*. Bacteria also change from a condition of movement to one of rest, when they cannot be entirely distinguished from common plant cells. They swarm only where there is favorable temperature, plenty of nourishment, and the presence of oxygen; under unfavorable conditions they are motionless. Certain kinds of spherical bacteria appear never to move.†

Like all living organisms, bacteria are capable of propagating themselves. This propagation depends on bi-partition ("fission"). The bacterium grows till it has reached perhaps double its original size, then constricts itself in the middle like a figure eight, and breaks into two new individuals; each of these in a short time divides again, and on account of the rapidity of this process we usually find them multiplying, either constricted in the middle, or hanging together in pairs. The warmer the air, the faster proceeds the division, and the stronger the multiplication; in a lower temperature it becomes slower, and ceases entirely in the neighborhood of the freezing point. It well repays the trouble to make by computation an exhibition of the incredible masses to which these smallest of all organisms are capable of multiplying themselves. We know that bacteria divide themselves in the space of an hour into two parts, then again after another hour into four, after three hours into eight, etc. After twenty-four hours the number exceeds sixteen and a half

doubt in all the true bacteria; the botanists who have best studied them, M. Warming for example, recognize that it is scarcely probable that these organs are the cause of their movements, for 'one meets some examples in which the body remains motionless while the cilia are in violent agitation, and others in which the body moves, while the cilia remain inert, or dragging behind.'"—MAGNIN.

† *Micrococcus*, COHN.

Bacillus anthracis, COHN. *Bacteridie charbonneuse*, DAVAINE.

millions (16,777,220); at the end of two days this bacterium will have multiplied to the incredible number of 281,500,000,000; at the end of three days it will have increased to forty-eight trillions; and after a week the number can only be expressed by figures of fifty-one places. In order to make this number comprehensible, we will reckon the mass and weight which may result from the multiplication of a single bacterium. A single individual of the most common species of rod bacteria (*Bacterium termo*) has the appearance of a short cylinder of a thousandth of a millimetre in diameter, and perhaps one five-hundredth of a millimetre in length. Let us now think of a cube, the side measuring a millimetre (cubic millimetre), six hundred and thirty-three millions of rod bacteria will completely fill this cavity without leaving any empty space. The fortieth part of a cubic millimetre would perhaps contain the bacteria that proceed from one single little rod in twenty-four hours; but at the end of the following day the bacteria would fill a space equal to 442,570 such cubes, or what is the same, perhaps, one-half a litre, or forty-four and a half cubic centimetres. Take the space which is occupied by the seas of this world, about two-thirds of the terrestrial surface, say with a mean depth of a mile, the collective contents of which would be nine hundred and twenty-nine millions of cubic miles; by continual progression of multiplication the bacteria which spring from one germ would in less than five days fill the whole world's seas completely full; the number can only be expressed by figures of thirty-seven places. Still more surprising are the proportional weights. If we call the specific weight of one bacterium equal to that of water, which cannot be far from the truth, it appears from the above mentioned measure that a single little rod will weigh 0.000,000,001,571 milligrammes, or that six hundred and thirty-six milliards of bacteria would weigh one gramme, or six hundred and thirty-six thousand milliards a kilogramme; after twenty-four hours the weight of the bacteria amounts to about one fortieth of a milligramme; after forty-eight hours, nearly one pound (442 grammes); after three days it approximates a weight of nearly seven and one-half million kilogrammes, or 148,356 hundred weight.

We do not consider such computations idle play; they alone can make the immense work executed by the bacteria comprehensible to

us. They also depend only on such hypotheses as nature herself presents to us; should, for example, the continuance of the process of fission be in truth somewhat longer than that stated by us, the numbers would agree in a few hours or days later. Certainly if in limited space this quantity is at no time reached, it perhaps does not signify that the power of multiplication in the bacteria falls below the calculation, but rather depends altogether on the limited nutrition. It is self-evident that bacteria do not generate the material which forms their bodies, but take it in from without as food, and therefore no more can be formed than there is food provided for. It follows that other animals and plants are assigned to the same food, and they on their side strive for existence. The fierce combat concerning life, according to the old usage of the extermination of the weaker, holds the increase of the bacteria, as of all other beings, in limitation; and it is only where they hold the upper hand that they are able to keep off the rivals which at the same time are their deadly enemies. A compressed yeast factory gives a plain example of the colossal proportions in which these little microscopic organisms can increase if abundance of nourishment is given them, and they are carefully protected from the opposition of other beings. The yeast fungus exceeds the rod bacteria in mass and weight probably one hundred and sixty fold.* The weight of a yeast cell is also about 0.000,000,25 milligrammes, or forty millions of yeast cells weigh one kilogramme. If they are in great vats filled with suitable food, and are allowed to remain undisturbed, inside of twenty-four hours over one hundred weight of yeast is generated. Probably there are more than fifty milliards of cells which form such a mass in the course of one day from one single grain.

We as yet know of no other mode of increase in the bacteria beside bi-partition. Generation of eggs and spores, as is found of all other animals and plants, has not yet been observed in these simplest forms.† After division the halves of the bacteria separate, and

* I accept a yeast cell as a spherule whose diameter is 0.008 of a millimetre, and whose contents is 0.000,000,25 mm. In the compressed yeast factory of Giesmannsdorf, near Neisse, 100 centimetres of yeast consists of 75% of water and 25% of yeast fungus.

† Since writing the above the author has satisfied himself not only of the existence of spores, but of veritable sporangia, and has by experiment found that the spores

wander about as independent organisms, or remain connected chain-like, and form longer or shorter threads; in other cases whole generations remain congregated in colonies, united in nests or balls, or collected together in heaps, which appear to the naked eye as colorless or perhaps colored gelatinous or slimy masses,† as little white flakes or threads swimming in the water, or settle as flakes to the bottom of the fluid.

Bacteria belong to the most wide-spread of organisms; we may say they are omnipresent; they never fail either in air or water; they attach themselves to the surface of all firm bodies, but develop in masses only where decomposition, corruption, fermentation or putrefaction are present. If we place a piece of flesh, a pea or other animal or vegetable material in water, it will become, earlier or later, thick, and then milky. It loses its transparency, because the bacteria completely fill the water; at the same time the putrefaction increases, under the development of different, and for the most part bad smelling chemical combinations. After a time the thickness disappears, and the water becomes clear and odorless, the organic material is consumed by the bacteria; these now cease to divide themselves further, and heap themselves on the bottom without motion as white sediment. If a new supply of nutritive material be added to the

of *Bacillus* will for several days withstand a temperature of 80° (176° Fah.), still retaining the power of germination, while, along with Frisch, he has proven that gradual freezing does not destroy them, development having occurred after exposure to a temperature of —87° (—123° Fah.). He states that "reproduction by means of spores is only made under the influence of free access of air." Bacteria spores, besides their ability of resisting vicissitudes of temperature, will withstand complete desiccation; and Magnin says: "These spores are the point of departure of epidemic foci, and their extreme lightness explains how readily they are disseminated by the wind. It has been shown from the experiments of Cohn and Miquel that the atmosphere contains very few adult bacteria; while Cohn again proves that these germs are of so small a diameter that they pass through all filters."

† "Cohn explains the origin of the gelatinous substance in which the bacteria are included as being produced by a thickening or jellification of the cell membrane; but a more plausible view is that it is produced by a secretion from their protoplasm. It is commonly the spherical bacteria (*Micrococcus*) and the microbacteria (*Bacterium*) which are found in this state. The bacteria are of course motionless in the *Zoögloca* on account of the intermediary glairy substance."—MAGNIN.

The filliform bacteria and the spirilla, according to Cohn, are never found in gelatinous masses, but may be found in active swarms.

fluid, putrefaction and the multiplication of bacteria which are not dead, but in a state of temporary repose, are seen to begin anew.

They also multiply without water in moist air wherever they can find decaying matter. They cover cheese, cooked potatoes and other foods in damp closets with a slimy, colorless or colored coating, which even with the naked eye is easily distinguished from the snow white web-like mould fungus, sprinkled with blue white spore powder. A great part of the whitish slime that collects on the teeth is composed of bacteria (*Vibrio rugula*).

But how is it now that bacteria always develop in impure materials? In what relation do they stand to putrefaction? To these questions different answers are given.

One says: In the bodies of all living animals and plants the chemical elements are united in a peculiar combination called organic combination. Death loosens the bond by means of which the vital power of the elements was held. This leaves them to the free play of their attractions, and it follows that they rearrange themselves into new and more simple combination, the oxygen at the same time seeking to unite itself with the air, to which certain materials of the dead body have a close affinity. So results separation, disorganization, and new formation, through which the form and organization of the dead body becomes entirely destroyed. It is this process that we designate putrefaction and decay. It is a purely chemical process, comparable to combustion, effervescence, or the rust of metals. Bacteria find abundant nourishment in the combinations formed by putrefaction, while they can not be nourished on living bodies; no wonder then if their germ, if it find access only singly, increases so extraordinarily by putrefaction.

If this conception be true, bacteria are only chance accompaniers of decay, and the putrefaction of dead bodies must take place under special conditions, therefore, even if bacteria are kept away.

These conditions are not easily obtained if we wish to try experiments in order to prove the truth of this supposition. If for example we place a piece or some of the juice of an animal or plant, flesh, blood, urine, leaves, fruit or seeds in a small glass flask, it is most probable that a few of the extraordinarily wide spread bacteria would be placed in with it, and this supposition becomes almost a

certainty if we add any water to the flask. It requires but a simple means to banish all the bacteria from the flask by cooking the same for a long time. Bacteria withstand boiling heat as little as other plants and animals; recent experiments have even shown that bacteria are killed by a temperature of 60° C., only the temperature must continue long enough to make sure that the whole mass has been penetrated, and not a single bacterium has escaped destruction. Decay is not removed by cooking alone; experience teaches that cooked flesh, eggs, milk, etc., take a much longer time, but finally decay as well as raw.

If one kills the bacteria already in the flask by means of heat, he must take care that no new germs enter from the air. For this purpose the Italian Abbe Spallanzani, an observer of nature in the last century, celebrated for his shrewd experiments, melted the neck of the little flask together during the cooking; the result was that the animal and plant material enclosed in the flask remained for all time unchanged, without putrefaction.

The French Count Appert used this method in the commencement of our century, in order to protect meat, vegetables, and other foods, by enclosing them in a metal box furnished with a small opening, then cooked them in a water-bath a couple of hours, and during the cooking soldered the opening; every housewife knows that food will keep for years in metal boxes without spoiling. Certain industries employ this method in preserving food in quantities; we indeed receive beef from Australia, and mutton from America, which is perhaps years old, but which when used is as if fresh.

The assertion has been made that the materials enclosed in the glass flask of Spallanzani, and the metal box by Appert, remained fresh not because there were no bacteria in them, but rather because there was no oxygen present; for it is certain that, by cooking, the air is expelled, and that the entrance of new oxygen through the soldering is impossible. In order to refute this objection, we must allow air free from bacteria to enter the hermetically sealed vessel. To accompish this, Dr. Schwann in 1837 so modified the experiment of Spallanzani, that he did not melt the neck of the flask until after air had been blow in through a red-hot tube. By this process certainly all the living germs were destroyed.

Schröder and Dusch gave in 1854 a more convenient method; they stopped the neck of the little flask with cleansed cotton. After cooking, as the air penetrated into the flask by the cooling of the same, all the germs were retained between the fibres of the cotton, as in a filter.

Finally, in 1863, Pasteur thought of a more simple method. He drew the neck of the flask out, and bent it down horse-shoe shape without melting it; the germs contained in the air, which following gravitation, usually settle down in open vessels, could no more obtain entrance into the flask.

The result of these methods was always the same; the materials enclosed in the little flasks never fell into putrefaction; although there was no lack of air, only the bacteria found no entrance. From this and many similar experiments it may be concluded, with the greatest certainty, that where all other conditions for putrefaction are given, this still does not take place if no bacteria are present. On the contrary, putrefaction begins the moment that bacteria are intentionally or unintentionally added, should this be in the least number. Putrefaction goes on in the same measure in which the bacteria increase; all circumstances which favor the increase of the bacteria accelerate putrefaction; all circumstances which hinder their development delay putrefaction; and all means which destroy bacteria remove putrefaction. On the other hand the multiplication of bacteria ceases as soon as the substances capable of producing putrefaction are destroyed.

Therefore bacteria are not the chance companions, but rather the cause of putrefaction. *Putrefaction is a chemical process, excited by bacteria.* Death does not, as is generally supposed, cause putrefaction, but rather it is caused by the life of these invisible organisms.

It appears almost self-evident that every body from which life has departed submits to corruption; and still this is known that without the life energy of bacteria all bodies after death would retain their form and combination as well as the Egyptian mummies, or the giants sunk in the Danish moors, or the mammoth and rhinoceros corpses which have remained frozen in the Siberian ice for unnumbered thousands of years, and which still retain their skin and hair uninjured. But as soon as the ice melts these last remains of an

extinct animal world sink in a few days to corruption. The cause of this is easily comprehended: the life energy of the bacteria is suspended in the neighbourhood of the freezing point, while they, in a somewhat higher temperature, immediately multiply and excite putrefaction. In the bog, and in mummies, it is the chemical mixture which hinders the development of the bacteria. When a little piece of flesh or of plant material has remained unchanged for years in a little flask arranged after the method of Spallanzani, Schröder, Dusch, or Pasteur, one requires to add to it only a single drop of water containing bacteria in order immediately to usher in putrefaction.

The whole arrangement of nature is based on this, that the body in which life has been extinguished succumbs to dissolution, in order that its material may become again serviceable to new life. If the amount of material which can be moulded into living beings is limited on the earth, the same particles of material must ever be converted from dead into living bodies in an eternal circle; if the wandering of the soul be a myth, the wandering of matter is a scientific fact. If there were no bacteria, the material embodied in animals and plants of one generation would after their decease remain bound, as are the chemical combinations in the rocks; new life could not develop, because there would be a lack of body material. Since bacteria cause the dead body to come to the earth in rapid putrefaction, they alone cause the springing forth of new life, and therefore make the continuance of living creatures possible. The wonderful fact that putrefaction is a work performed by bacteria does not stand alone; there is an entire series of chemical changes which are produced by bacteria and similar microscopic forms. These processes are usually designated as fermentation phenomena, and the organisms which cause the same as fermentation fungi; among the bacteria the one that has been designated by investigators as *Bacterium termo* is the ferment of putrefaction.

That ferment which has been longest known, and most closely observed, is the alcohol ferment (*Saccharomyces cervisiæ*). Its little oval globules were first observed by Leeuwenhoek in beer, but in 1837 were known by Cagnaird Latour, and about the same time by Schwann, as the cause of the ferment which changed sugar into

carbonic acid and alcohol, while a small quantity of glycerine and succinic acid were formed. For the closest observations concerning the relation of yeast fungus to alcohol fermentation, we are indebted to Pasteur, from whose fame as the most ingenious and exact of modern French observers, we will not detract, even if he has not held himself aloof from the want of taste which would carry the bitterness of national passion into the neutral field of science. Pasteur showed that yeast fungus was composed of the same material as all other plants—of carbon, oxygen, hydrogen and nitrogen, and a number of minerals, among which potash and phosphoric acid are the most important. If the yeast plant grow, all these materials must be received as food, and applied by its life energy to the building of its cells. Yeast fungus does not find the whole of its nourishment in clear sugar, but as well in the pressed out juice of grapes, in beer wort and other fermentables; it multiplies itself only where it finds these. Oxygen and hydrogen are given to it in water; mineral materials which are identified later in the yeast ashes must also be present in solution. It was formerly thought that the yeast plant could only take up nitrogen from albuminous compounds, which are never wanting in juice of grapes and beer wort. Pasteur showed that the need of nitrogen can be satisfied through the taking in of ammonia, which consists of nitrogen and hydrogen. Finally, the yeast plant receives its carbon directly and exclusively from the sugar; probably the albumen which is present in the cell is formed by a combination of the sugar with the ammonia. Now, since the yeast plant needs the sugar in order to form, nourish and multiply its particular cells, it causes a dissolution of the sugar, and a new arrangement of its finest particles; this gives rise to the change, which has been designated alcohol fermentation. If the fermentation is over, the sugar has also disappeared, and the yeast plant can no more multiply; it settles itself in the bottom of the fluid as dregs, or is thrown out by the violent escaping of carbonic acid, as foam or yeast, on the top.

Other fermentations are caused by bacteria, or by microscopical organisms which are related to bacteria only as they multiply themselves through division or parting of their cells, and on that account are united with bacteria in the class *Schizomycetes*. If beer or wine,

through time or exposure to the air, becomes sour, acetic acid is formed: it is through bacteria,* which are united in long chains, or bound together in a slimy veil, that the alcohol of spirituous liquors becomes changed to acetic acid. Pasteur has shown that all diseases of wine are caused by microscopic ferment fungi, whose germs get into the fluid during the wine making, and there multiply themselves more or less rapidly. To him belongs the credit of at the same time turning this discovery to the practical account of the wine makers. When the wine is heated in the flasks to from 50° to 70° C., not only the acetic ferment, but also the schizomycetes are killed which make the wine mouldy, slimy or bitter—the wine becomes lasting, can be decanted, and increases in fire, bouquet and value.

When sweet milk becomes sour, it rests on this, that the sugar of milk is changed into lactic acid. Here is also a ferment fungus from the class of the bacteria, as Pasteur has proved.† When the milk is cooked, the lactic acid ferment is killed, and if the entrance of new germs is hindered, the milk will remain sweet through unlimited time. The same lactic acid ferment also plays a part in the preparation of saurkraut, cucumber pickles, &c. It develops in beet juice and in beer wort, and thus does much injury to the manufacturer.

Other ferment fungi cause other fermentations; one makes urine alkaline,‡ another changes tannin into gallic acid; still another plays a great *rôle* in butyric acid fermentation, and in the manufacture of

* *Mycoderma aceti*, PASTEUR.

"These little beings reproduce themselves with such rapidity that by placing an imperceptible germ upon the surface of a liquid contained in a vat having a surface of one square metre, we may see it covered in from twenty-four to forty-eight hours with a uniform velvety veil" (Duclaux). This veil is the so-called *mother of vinegar*. The *mycoderma aceti* must be distinguished from the *mycoderma vini*, which, while it develops in similar situations, is a species of *saccharomycete*, and is known commonly as *flowers of wine*. "In order that acetification may occur, the oxygen of the air is necessary. Once submerged, the *mycoderma aceti* develops, but no longer produces acetic acid (Magnin). However: "In effect, it is not then arrested in its work; and without changing form or mode of action, it carries the oxygen of the air to the acetic acid which it has produced, transforming it into carbonic acid and water. If we add some alcohol to the liquid, the phenomena change, the acid is respected, and the alcohol is transformed anew into acetic acid" (Duclaux).

† *Vibrio lactis*, PASTEUR.

‡ *Micrococcus ureæ*, COHN, transforming urea into carbonate of ammonia.

cheese; † but especially interesting are the ferment fungi of the class of spherical bacteria which originate coloring matter.‡

It has long been a saying that suddenly, from time to time, a drop of blood would form on food, and especially on bread, and so increase that it would spread over wide surfaces. This was observed in ancient times, and it was held that it was a sign of threatened disaster, that it showed the anger of God, disclosed secret guilt, and called for bloody atonement; and history records numberless sacrifices which, till recent time, fell to the superstition, as often as this wonder of blood was seen on food, but especially if on the consecrated wafer.

With a century of enlightenment the blood wonder gradually ceased; but only within the last ten years do we know that the wonderful account had foundation in a fact of science. It was Ehrenberg who first investigated this appearance of blood most carefully. It formed itself in moist air, on cooked, not on raw food; on potatoes, rice, paste; also on flesh, milk and white of egg, and of itself, without any one voluntarily causing it to be produced. At first it appeared as a very small rosy red or purple slimy drop, which grew to the size of a pin head, and appeared like fish spawn; then it flat-

† *Bacillus subtilis*, COHN (*Ferment butyrique*, PASTEUR).

"Butyric fermentation is in fact always preceded by a lactic transformation, and it is by an ulterior modification that the lactic acid produces the butyric acid. The reaction, represented by the phenomena, from a chemical point of view, is the following:

$$\underbrace{2\,C^3\,H^6\,O^3}_{\text{Lactic acid.}} = \underbrace{C^4\,H^8\,O^2}_{\text{Butyric acid.}} + 2\,C\,O^2 + H^4$$

This fermentation resembles putrefaction in a great many particulars. Indeed some authors include it under the same head" (MAGNIN).

‡ *Micrococcus chromogenes*, COHN.

"The pigmentary bacteria grow in the state of *Zoögloca*, upon the surface of the substances which furnish them with nutriment. They are always alkaline; all are avid of oxygen; their morphological characters are identical, and one can only distinguish them by their different coloring properties.

According to Cohn they are veritable species; for, 1. Their pigments offer the greatest diversity as to chemical action, and by spectroscopic analysis, etc. 2. Each species cultivated in the most diverse media produces always the same coloring matter.

They are divided into two categories, according as the pigment is soluble or not in water" (MAGNIN).

tened, ran together, and formed a thick bloody slime. If one spread out the red drop of gelatine-like substance on a fresh potato, it would multiply rapidly, and it has with ease been increased to so great a quantity that it could be used for coloring; unfortunately this coloring material is not durable, being soon destroyed by the light. Ehrenberg found in the red slime numberless little oval bodies, to which he gave the name of *Monas prodigiosus;* we designate them better as red spherical bacteria (*Micrococcus prodigiosus*). They nourish themselves on the albumen contained in the food on the surface of which they develop, decompose the same, and generate, by a peculiar pigment fermentation, the red coloring matter, which, as Otto Erdman * and Schröter † have shown, possess a striking relation to that brilliant aniline color, which at the present time is of so much value to the coloring industry.

In historical interest, and in the mighty impression which it exercised on the myth-forming fancy of the people, the wonder blood stands alone; as a physical phenomenon it takes on a whole series of colors, which appear almost as a rule in moist places, on potatoes, cheese, cooked eggs and other foods; in appearance snow white, sulphur yellow, Spanish green, violet, blue or brown flecks, little drops or masses of mucus; all these colors, which are also related in part to aniline dyes, originate from spherical bacteria, which, under the microscope, can scarcely be distinguished from the *Micrococcus prodigiosus* of the wonder blood. If milk turns red or yellow of itself, or the pus from a wound takes a Spanish green color, the rod bacteria are designated as the originators of this coloring material.‡ The litmus so much used by chemists is obtained, together with a few related pigments, from branching or crusty rock growing lichens by placing them in water as long as putrefaction continues, till the at first colorless extract takes on a beautiful purple, red or blue color wherever it comes in contact with the air. According to recent in-

* "Bildung von anilen Farben aus protein Körpern,"—Journal für praktische Chemie, 1866.

† Schröter über einige durch Bacterien gebildete pigmente, in Cohn's Beiträge zur Biologie der Pflanzen. 1, 2. Heft. 109-126.

‡ *Bacterium xanthinum*, SCHROETER. (*Vibrio synxanthus*, EHRB.)
Bacterium syncyanum, SCHROETER. (*Vibrio syncyanus*, EHRB.)
Bacterium æruginosum, SCHROETER.

vestigations, it is probable that litmus also is formed through the life energy of bacteria. They have succeeded by means of bacteria in producing, in a clear solution containing cream of tartar and acetate of ammonia, a coloring material exactly similar to litmus, which first colors the fluid a clear blue, becoming from day to day deeper and more beautiful. In other investigations the spherical bacteria appear to a certain extent as fabricators of Spanish green, yellow and red coloring materials, which they are able to produce from colorless chemical solutions.

At last, in the most recent times, an unexpected knowledge of the secret life energies of bacteria has been revealed, through which they rule with demoniacal power over the weal and woe, and even over the life and death of man.

Probably with the increase of commerce the visitation of that scourge of God, the epidemic, has grown more frequent, in the last ten years, on man and animals. It wanders with undetainable progress from city to city, from land to land, stopping at one place but a short time, then, as if exhausted, disappearing in order to carry on its work in a new locality, and usually after an interval of time, turning back again. Only too often the physician's skill and knowledge are exercised in vain to wrest the victim from the devastating power of these diseases, or to limit their course by rules of precaution. As various as are the different forms of disease, yet all epidemics, cholera, pestilence, typhus, diphtheria, variola, scarletina, hospital gangrene, epizoötic, and the like, have certain features in common. These diseases originate nowhere of themselves, neither from internal nor external causes, but are introduced from another place where they have been prevalent, by means of a diseased person or through material which has been in contact with such: they spread only through contagion. When the infection has taken place, hours or even days may pass before the symptoms appear outwardly. After a certain time of incubation, the disease breaks out through a powerful disturbance of the normal action of all the organs, from the brain to the digestive system; the diseased person appears as if he were under the influence of a poison which had penetrated into his blood; and as he himself is infected by the virus, he spreads it further by the breath, by the perspiration, by the excretions, even in

the clothing or the washing. In many diseases the contagious material collects in a concentrated form in peculiar pustules or blisters, whose clear humor, in the slightest quantity, is sufficient to infect a sound person as soon as it has been received into his circulation, and to place him under the same appearances of disease as the originator of the poison. A breeze is sufficient to poison every open wound by the poison that adheres to the knife of the surgeon or anatomist. In anthrax it is positive that a fly may convey the poison from a diseased to a sound animal.

Scarcely had Leeuwenhoek made known his first observations upon the invisible creatures in rain water, when visionary physicians believed the premature hypothesis that the frightful enigma of epidemics was explained through the wafting of microscopical diseased germs. But until the most recent times, every endeavor, even with the help of the microscope, to find with certainty living organisms in the contagious material which originated with the disease, has been in vain. It were as easy to bring to sight the invisible arrow with which, according to the belief of the ancients, the far-darting Apollo in his anger prostrated men and cattle.

The first discovery of microscopical organisms in contagious diseases we owe to Davaine,* who in the year 1863 observed in the blood of a splenetic animal, a few hours before its death, numberless fine thread-like forms, which were almost double the length of blood corpuscles, which multiplied themselves by division, and could be distinguished from the ordinary fibre bacteria only through their lack of motion. Davaine on that account designated them *Bacteridia*. Man is subject to a contagious disease which is very nearly related to anthrax,† and in these cases the blood is filled with *Bacteridia*. Within about four years the number of epidemics in which bacteria appear has very much increased.‡ This, however, is not the place to discuss separate cases; we will, therefore, consider some of the more important according to the most recent observations.

* C. Davaine, Recherches sur les maladies charbonneuses, C. R. Ac. des Sc., t. LVII., p. 220, 351, 386, et t. LIX., p. 393.

† *Pustula maligna.*

‡ We owe these facts to the observations of Keber, Hallier, Zürn, Klebs, Leyden, Recklinghausen, Jaffe, Waldeyer, Orth, Buhl, Hüter, Oertel, Traube and others.

Every one knows how mercilessly diphtheria destroys so many promising lives—an easily transmitted contagion, which usually firmly seats itself in the throat and air passages, generating there a membranous formation which threatens immediate death by suffocation. The microscope shows in all the organs of the diseased person numberless spherical bacteria, heaped together in thick masses, which pass through and besiege the tissues of the muscles, vessels and mucous membrane; everywhere congestion, inflammation, and a general blood poisoning, follow in consequence.

Blood poisoning through open wounds, which in war carries off more victims than the enemies' balls, and which, when it has gained a footing in a hospital, easily causes wounds to become fatal, is always accompanied by the multiplying of the spherical bacteria, which, sometimes singly, sometimes in wreath-like slimy heaps, settle themselves in the pus, or in the tissue of the scar, or are taken up in the blood and deposited in the different organs, where they cause inflammation, formation of abscesses, and through a consuming fever exhaust the most youthful vitality. In the clear lymph of cow or human pox spherical bacteria are also found in immense numbers, and undergoing rapid increase. In the rice water discharges of cholera, Kolb, as early as 1866, identified numberless bacteria bound together in gelatinous masses. Even the silk worm is subject to an epidemic in which bacteria appear.†

Does it then follow from the presence of bacteria that they truly have to do with epidemics? Is it not quite as probable that these microscopic forms are only chance and unessential accompaniers of disease? Bacteria certainly develop in every fermentation, and where there is any putrefaction, without exerting the least influence on health. As yet the diffused light of the most recent investigations is not clear enough to enable this dark province to be penetrated; as yet the newly won ground is not firm enough to warrant the building of an unshaken theory; still we already know that the bacteria of contagion are of a different kind from those which engender putrefaction; these are distinguished from the latter under the microscope mostly through their form; they exist under entirely different cir-

† *Micrococcus bombycis*, COHN.

cumstances of life; they often battle for existence with the bacteria of putrefaction, and are by them exterminated if they are conquered. Davaine found the bacteria of anthrax to disappear with the beginning of putrefaction, as early as forty-eight hours after the death of an animal; and the rod bacteria at the same time to multiply beyond measure. But, while a drop of blood filled with anthrax bacteria will, when introduced into a sound animal, produce death in from twenty-four to thirty-six hours, the inoculation with putrefied blood containing no bacteria, is without effect. The bacteria of anthrax do not lose their vitality through desiccation, therefore contagion may take effect through dried blood.

As is known, only fluid particles can pass through a compact filter, a clay cylinder, or a membrane; little firm bodies, be they ever so small being retained. Chauveau and Klebs made use of these experiments, in order to show that in pyæmia, septicæmia, and variola, the contagion may not have its seat in the fluid portion of the pus or lymph, but in the microscopical spherical bacteria which develop in it. As they strained this same contagious material through a filter, they ascertained that the clear fluid which had passed through the filter had lost its contagious power, while the firm substances which remained on the filter were efficient.

All these facts make it in the highest degree probable that the already identified bacteria are in many diseases the conveyors and originators of infection, that they are the ferment of contagion. We have the firm conviction that to a more thorough and clearer knowledge of these facts will be joined the discovery of new methods by which to encounter the fearful enemy with better success than hitherto. The skill of the physician should be exerted to answer the following questions: In what way takes place, and in what manner can be hindered the transportation of microscopical organisms of fermentation? and, Through what means can the multiplication of the same be arrested? Especially should their attention be turned to water, of which it is ascertained that when in a seemingly pure condition, it is an easy conveyance for the transmission of bacteria and other ferment organisms.

We have seen that bacteria multiply, under favorable circumstances, in all putrefaction and fermentation and in many diseases,

as soon as their germ has once found access; that these smallest of organisms accomplish a vast work through the immense numbers in which they develope. But from whence is derived the first germ? With this question naturalists have busied themselves up to the most recent time, and their answers have been various.

One says: by putrefaction, the organic elements which had composed the body of the dead animal, form themselves by free creative power into independent beings, which differ entirely from those from which their material was produced, yet are in every case animated, and have the power of propagation; thus the albumin and little fat globules take the form of bacteria, perhaps also of yeast fungus and mould, or even of those little infusorial animals whose presence never fails in corruption. Indeed an especial name has been found for this mode of origin, *Generatio æquivoca*, or equivocal generation.

Another disputes the possibility of living beings, however small and simple, ever originating in any other way than from germinal matter which sprang from the same form of life; and insists that the belief in the equivocal origin of bacteria is the last remnant of an old superstition, which the light of science has not entirely banished. In ancient times it was thought that there originated from slime, serpents and frogs, which the sun brooded, that caterpillars generated from decayed leaves, vermin from filth, and worms from spoiled meat. Nowadays every child knows that all these things are fables; every housewife knows by experience that no maggots originate in meat, if the blow-fly is prevented by a wire screen from entering and depositing its eggs. They have learned through careful covering, to keep away the minute mould spores, which settle with other dust from the air, and which colonize on their preserved fruits; they know that trichina and tape-worm only originate from raw or half-cooked pork, in which these animals were already present in the embryonic stage. Even the farmer no longer believes that the grain rust originates from chilling, but that it springs from germs which are scattered by the barberry bushes, or other fallen stalks, and that the blight may be arrested in wheat, if the seed is strained through sulphate of copper, in order to kill the spores which cling to it.

Concerning bacteria and their related fermentations, the above mentioned observations lead without doubt to the conclusion that

they originate as little through equivocal generation as other living organisms; for when nitrogenous material from the animal and plant world is cooked in flasks, even at as low a temperature as 60° C., all the bacteria are killed, and if the entrance of new germs from outside is in every way hindered, and it were possible to keep the little flask forever, no bacteria would ever originate of themselves. On the contrary the entrance of a single germ is sufficient to cause multiplication, and with it putrefaction. If bacteria originate from putrid material through equivocal generation, putrefaction must appear before bacteria; but experience shows the contrary, that putrefaction is a consequence of the development of bacteria. Within the last few years a theory has caused some sensation by seeking to account for the origin of bacteria by saying that the ordinary mould-fungus will, under certain conditions bring forth moving germs of extraordinary minuteness; which germs are capable of developing into bacteria, into yeast, and finally again into mould. When bacteria are found in the blood or other organs in certain diseases, the authors of this theory are satisfied that the spores of common mould or blight fungus germinate in the human body; that these germs first swarm as bacteria, but under suitable culture may be nourished into different kinds of mould. However, unprejudiced research has not given the slightest proof that bacteria stand in any connection with the history of the development of yeast, blight, or mould fungus. They always originate, as far as we know at present, from germs of the same kind.

Through these facts we surely have a right to hope, that in the development of bacteria the key will be found to the origin of life in the world in general. If we could prove that through equivocal generation, one single organism, or living cell, shaped itself from unorganized and lifeless material, then could we conceive that the first created beings were in the beginning formed in a similar manner.

Now it is very certain that life had a beginning on the earth, but how did the first living beings originate? For this all analogy is wanting. According to our present knowledge life may be compared to the holy fire of Vesta, which is eternally maintained, through the kindling of the new brand from the old.

The famous physicist, Wyville Thompson, in an ingenious speech

with which he opened the Natural Science Convention in Edinburg, drew the following conclusions: that life on this earth, not having originated of itself, must therefore have been conveyed to our world from another. We know that the numberless meteoric stones which have fallen to the earth, were once independent bodies or parts of such. In certain meteorites carbon, and certain combinations containing carbon, have been found, which points to organic formation. It is possible to think, that at some time a germ, with life and capacity for development, could have survived the glowing heat which generally accompanies the entrance of a new comer from space into our atmosphere, and that from such a germ all living beings might have descended. Thus, some time the commencement of life may have descended from Heaven upon this lifeless earth; as according to the myth, the living spark was brought down by Prometheus from Olympia.

The development history of the bacteria allows us to think of another origin of life on the earth. We have calculated the weight of one bacterium at 0.000,000,001,57 milligrammes; we know that these infinitely light little bodies are carried away through the evaporation of water, and float around in the air as little particles of sun dust, and with the dust again settle down; but they may be carried by the winds to unmeasurable distances, and also to extraordinary heights. It is more probable that these particles of fine dust are sometimes carried up by ascending currents of air, so far that they are deprived of the attraction of our planet, and reach space. The existence of a world dust is presumable from certain cosmical appearances of light. Space is exceedingly cold, yet experiments prove that even a chilling for many hours below —18° does not kill bacteria; they become stiff through cold, from which condition they revive when thawed, and under favorable circumstances again begin to multiply.* It is perhaps not impossible that an ascending particle of bacteria dust, which has floated for a long time in space, may reach the atmosphere of another world, and if it find there circumstances favorable to life, it multiplies. On the other hand, it is possible to think that a germ of *Bacterium*, or any other exceedingly small and

* See previous note in regard to spores.

simple form, from some other life-nourishing world, may have been moving about in space, and that such a germ, finally reaching our atmosphere, settled to the earth. As long as the primitive sea retained a temperature above 60°, the development of such a germ would have been impossible; but as soon as the cooling had fallen below this temperature, the stray germ of life must have found in the sea, richly saturated with salt, conditions for unlimited multiplication. We have calculated that the whole ocean might be filled with such organisms in a few days. From these first living germs, in which the peculiarities of the animal and vegetable kingdoms are not yet separated, the laws of development, the battle for existence, natural increase, geographical distribution, and many other known and unknown forces might have produced the different forms of the animal and plant world, which inhabited the earth in the past, as they do in the present. We know well that in the maintenance of such views, we stray far from the boundaries of natural philosophy; but we find the naturalist, always remaining conscious of the limitations of his knowledge, admitting his ignorance with resignation, foiled in his experiments and observations; not always resisting the longing of Faust, "*Zu schauen alle Wirkungskraft und Samen*," but gladly giving himself up to the allurement of filling with some fantasy that blank at which modern investigation has failed.

THE END.

Fig. 4.

DESCRIPTION OF THE PLATE.

From "Microscopical Journal."

FIG. 1.—*Micrococcus prodigiosus* (*Monas prodigiosa*, Ehr.). Spherical bacteria of the red pigment, aggregated in pairs and in fours; the other pigment bacteria are not distinguishable with the microscope from this one.

FIG. 2.—*Micrococcus vaccinæ*. Spherical bacteria, from pock-lymph in a state of growth, aggregated in short four to eight-jointed straight or bent chains, and forming also irregular cell-mass.

FIG. 3.—Zoöglœa-form of micrococcus, pellicles or mucous strata characterized by granule-like closely set spherules.

FIG. 4.—Rosary-chain (Torula-form) of *Micrococcus ureæ*, from the urine.

FIG. 5.—Rosary-chain and yeast-like cell-masses from the white deposit of a solution of sugar of milk which had become sour.

FIG. 6.—*Saccharomyces glutinis* (*Cryptococcus glutinis*, Fersen.), a pollulating yeast which forms beautiful rose-colored patches on cooked potatoes.

FIG. 7.—Sarcina spec,* from the blood of a healthy man,** from the surface of a hen's egg grown over with *Micrococcus luteus*, forming yellow patches.

FIG. 8.—*Bacterium termo*, free motile form.

FIG. 9.—Zoöglœa form of *Bacterium termo*.

FIG. 10.—Bacterium-pellicle, formed by rod-shaped bacteria arranged one against the other in a linear fashion, from the surface of sour beer.

FIG. 11.—*Bacterium lineola*, free motile form.

FIG. 12.—Zoöglœa form of *B. lineola*.

FIG. 13.—Motile filamentous bacteria, with a spherical or elliptical highly refringent "head," perhaps developed from gonidia.

FIG. 14.—*Bacillus subtilis*, short cylinders and longer, very flexible motile filaments, some of which are in process of division.

FIG. 15.—*Bacillus ulna*, single segments and longer threads, some breaking up into segments.

FIG. 16.—*Vibrio rugula*, single, or in process of division.

FIG 17.—*Vibrio serpens*, longer or shorter threads, some dividing into bits, at * two threads entwined.

FIG 18.—"Swarm" of *V. serpens*, the threads felted.

FIG. 19.—*Spirillum tenue*, single and felted into "swarms."

FIG. 20.—*Spirillum undula*.

FIG. 21.—*Spirillum* volutans,* two spirals twisted around one another.

FIG. 22.—*Spirochæte plicatilis*.

All the figures were drawn by Dr. Ferdinand Cohn with the immersion lens No. IX. of Hartnack Ocular III., representing a magnifying power of 650 diameters.

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das bei der umfangreichen und über viele Journale zerstreuten Thätigkeit COHN's leider keinen Anspruch auf Vollständigkeit machen kann. Kleinere Mittheilungen in der „Schlesischen Gesellschaft", Artikel in Tageszeitungen, Aufsätze in belletristischen Organen sind nicht mit aufgezählt.

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A NOTE ON THE RECEPTION OF THE STETHOSCOPE IN ENGLAND

GEORGE ROSEN, M. D.

The study of medical history from the point of view of historical sociology soon leads the investigator to consider problems that have heretofore remained unnoticed. Many of these problems are concerned with the social interrelationship of medicine. A very important subject, for instance, is the diffusion of medical knowledge. Certain aspects of this subject which are more directly concerned with medicine and physicians in a narrow sense, e. g. medical journalism, have received some attention. But no attempt has been made to study the spread of medical knowledge among the lay public. Naturally the farther back one goes in human history the more difficult it will be to study such aspects of medical history.

Yet even more modern periods have remained unstudied. How did the layman of modern times react to medical advances? How soon did he learn about them? Through what media did he become acquainted with them? All these questions are of great interest, and yet for the most part they must still remain unanswered. Owing to this lack of knowledge concerning these aspects of medical history, any evidence bearing upon them is exceedingly significant. It is for this reason that attention is called to the following extract from the London *Times* of December 19, 1824. This paragraph is of interest because it throws light on the reaction of the English lay public to the recently invented stethoscope. Laennec had invented his instrument for mediate auscultation in 1816. At first there was some opposition in medical circles to its adoption and use. As late as 1829 we find John Elliotson in his Lumleian lectures defending the use of the stethoscope. The paragraph in the *Times* was written then during the period when the stethoscope had not yet been fully accepted in the English medical world. It reads as follows:

"A wonderful instrument called the Stethoscope, invented a few months ago, for the purpose of ascertaining the different stages of pulmonary affections, is now in complete vogue at Paris. It is

merely a hollow wooden tube, about a foot in length (a common flute, with the holes stopped and the top open, would do, perhaps, just as well). One end is applied to the breast of the patient, the other to the ear of the physician, and according to the different sounds, harsh, hollow, soft, loud, etc., he judges of the state of the disease. It is quite a fashion if a person complains of a cough, to have recourse to the miraculous tube, which, however, cannot effect a cure; but should you unfortunately perceive in the countenance of the Doctor, that he fancies certain symptoms exist, it is very likely that a nervous person might become seriously indisposed and convert the supposition into reality."

A perusal of this passage reveals several interesting points. In the first place no mention is made of Laennec. By 1824 his name was certainly well-known to English physicians and yet in a popular description of his instrument it is omitted. In the second place it is stated that the stethoscope had been invented only a few months prior to the writing of this passage. If this statement is taken at its face value as contemporary evidence it would appear that the English public first learned about the stethoscope some eight years after Laennec had first employed it. Naturally no generalization can be made on the basis of a single statement but it is certainly suggestive. The third point of interest is the mention of the great expectations of patients and the warning that the instrument cannot be used for curative purposes.

There is no doubt that these matters are of great interest and certainly more evidence would throw a greater light on the problem of the diffusion of medical knowledge among the general public. It is to be hoped that more attention will be paid to such problems in the future by both medical and social historians.

LAËNNEC AND CHATEAUBRIAND

GILBERT CHINARD

After studying botany with M. de Malesherbes in the Jardin du Roi, Chateaubriand had apparently given up his interest in the sciences, and except for the descriptions of the American fauna and flora in the *Voyage en Amérique* and *Atala*, his works contain no evidence that he paid any further attention to scientific subjects. Only once in his later years did he express any enthusiasm for the " wonders of nature " as revealed by science. The occasion is worth noting. In October 1818, Chateaubriand had founded with the publisher Le Normant and a few friends *Le Conservateur*, a journal published at irregular intervals and devoted mainly to politics and literature. Starting with the October number 1819, Chateaubriand undertook to present a picture of contemporary literary productions. He dealt at first with history and had planned to treat in the December number of " philosophy, novels and travels." It had never been his intention to include works on scientific subjects. In the meantime, however, he had heard of a recent discovery which seemed of such importance that he had to interrupt the order of his survey in order to insert the following page. After appearing in the *Conservateur* it was reprinted in the *Œuvres complètes*, Ladvocat ed., vol. XXI, p. 397 and Pourrat ed. vol. VIII, p. 327. It is a curious testimony of the interest aroused in the general public by the discovery of Laënnec. The spelling of Chateaubriand has been preserved.

LITTÉRATURE

(*Second et dernier article*) [1]

Après avoir traité des Lettres Sacrées et de l'Histoire, il conviendroit de parler des Sciences, mais nous manquons de ce courage, si commun aujourd'hui, de raisonner sur des choses que nous n'entendons pas. Dans la crainte de prendre le Pyrée pour un homme, nous nous abstiendrons. Néanmoins nous ne

[1] Voyez la LXIV^e^ Livraison du *Conservateur*.

pouvons résister à l'envie de dire un mot d'un ouvrage de science, que nous avons sous les yeux. Il est intitulé : de l'*Auscultation Médiate*.[2] Au moyen d'un tube appliqué aux parties extérieures du corps, notre savant compatriote breton, le docteur Lænec, est parvenu à reconnoître par la nature du bruit de la respiration, la nature des affections du cœur et de la poitrine. Cette belle et grande découverte fera époque dans l'histoire de l'art. Si l'on pouvoit inventer une machine pour entendre ce que se passe dans la conscience des hommes, cela seroit bien utile dans le temps où nous vivons. " C'est dans son génie que le médecin doit trouver les remèdes," a dit un autre médecin dans ses ingénieuses *Maximes*,[3] et l'ouvrage du docteur Lænec prouve la justesse de cette observation. Nous pensons aussi, comme l'Ecclésiastique, " que toute médecine vient de Dieu, et qu'un bon ami est la médecine du cœur."

[2] Deux vol. in-8°. Prix : 13 fr., et 16 fr. par la poste. A Paris, chez Brosson, et le Normant.

[3] *Maximes, Réflexions et Pensées diverses*, par M. Beauchêne.

THREE CASES OF VAGINISM

C. GRANT LOOMIS
Harvard University

Hagiological records contain many a strange and unexpected item. An occurrence which is apparently miraculous is often a recognized phenomenon in more enlightened days. The three excerpts brought together here from different sources, which date roughly from the twelfth to the fourteenth centuries, may be of interest to the student of medical history. The first two accounts seem to be sufficiently explicit to warrant a definite assumption about their real nature. The third derives credulity by analogy. We must premise, of course, that we are dealing with a real occurrence and not with a hagiologist's fiction. Since vaginism is a perfectly recognizable and not unusual phenomenon, we may presume that we are interpreting in these cases a real fact.

In the life of Saint Clitaucus we find the following:

> Potens quidam die dominico cum uxore ad audiendum dei seruitium in ecclesia sancti Clitauci veniens, super ripam fluminis, non longe ab ecclesia positam, cum uxore sua concubuit, et peccato commiso, ab illa separari non potuit, immo iunctus uxori inseparabilis remansit. Et exclamans sodalibus voce magna dixit: 'Ite ad sepulchrum martyris Clitauci, et pratum istud, a me vi et iniuste ablatum, sibi restitui promittite, et pro me suppliciter queso intercedite.' Quo facto, ab horribili ligamine statim liberatus est.[1]

A similar happening is told in the life of Saint Guignerus. Here we have an interesting physical and moral variant:

> Super sarcophagum venerabilis cuiusdam Episcopi, qui contubernalibus fuerat Regis Clitonis, corruptor quidam gremia cuiusdam mulieris incestare præsumpsit; qui more canum in ipso opere turpitudinis inseparabiliter

[1] C. Horstmann, *Nova Legenda Anglie*, Oxford, 1901, vol. I, p. 190.

copulati, nulla poterant ratione ab inuicem separari. Adducuntur tandem ad memoriam martyris gloriosi Guigneri, ubi merito testis Christi & intercessione fidelium liberantur.[2]

A third brief statement suggests a similar situation:

Miraculum de quadam muliere quae viro conjugato adhæsit et eum non sinebat ad uxorem propriam remeare.[3]

[2] *Acta Sanctorum*, Bollandist Society, Antwerp, 1643—, March, vol. III, p. 459, col. 2. Auctor se Anselmum nominat. Ex MS. Parisiensi S. Victoris. (Early 12th century?).

[3] *Analecta Bollandiana*, vol. VIII, p. 188. (Bibl. Civit. Carnot. Codex 212. Saec. XIII). This appears in a list of the miracles of the Virgin Mary.

YUGOSLAVIA AND THE XI-TH INTERNATIONAL CONGRESS OF THE HISTORY OF MEDICINE

HENRY E. SIGERIST

The *International Society of the History of Medicine* was organized in Paris in 1921 following a resolution of the International Congress of the Healing Art held in Antwerp in 1920. The Society has national sections in most countries and our American Association of the History of Medicine is acting as American and Canadian Section of the International Society. Each national section elects a delegate who upon approval of the International Society becomes a member of the Permanent Committee whose seat is in Paris. The Permanent Committee and the officers direct the affairs of the Society. The official organ of the Society is the monthly journal *Aesculape* and since 1936 the Society is publishing at irregular intervals *Archives de la Société Internationale d'Histoire de la Médecine*. The Society in addition publishes the transactions of its Congresses.

The organization of congresses has been so far the chief activity of the Society. Other tasks of international cooperation such as the compilation of a catalogue of mediaeval medical manuscripts, or the publication of a more scholarly international journal were frequently discussed. The Society however has no funds available and the currency restrictions prevailing in most European countries would make it very difficult to publish such a journal at present. The organization of international congresses has therefore remained the most important function of the Society. These congresses are as a rule held every three years.[1]

The last such meeting took place in Madrid in September 1935. These glorious autumn days will remain unforgettable to all who

[1] The following international congresses of the history of medicine have been held in the past: Antwerp, 1920; Paris, 1921; London, 1922; Bruxelles, 1923 (as section of the International History Congress); Geneva, 1925; Leiden-Amsterdam, 1927; Oslo, 1928 (as section of the International History Congress); Rome, 1930; Bucharest, 1932; Madrid, 1935.

were privileged in attending this gathering. The tragedy that was soon to befall the Spanish people was in the air already and could be perceived by whoever knows how to feel the pulse of a country. We were brilliantly received by high officials, archbishops and generals. We were entertained lavishly, but when we drove from Madrid to Toledo where the meeting was to be opened formally, we saw poor peasants tilling the soil with hand-plows and mills operated by blindfolded donkeys, while in Toledo, in the cathedral, we found buckets full of pearls and precious stones. Life was gay enough in daytime, but at night the streets assumed the aspect of a besieged city with large detachments of police, infantry and cavalry patrolling the streets. And in the hotel my elevator boy and waiter studied the works of Karl Marx. One year after we had been offered a magnificent banquet in the Alcazar of Toledo, the latter was blown up and the President of the Madrid Congress Gregorio Marañon is now living abroad while we are sending American physicians to help the Spanish people in their struggle for independence.

The Congress of 1938 was to be held in Athens, Constantinople, Sophia and Zagreb, but Greece and Bulgaria felt unable to receive the Society. Turkey wanted to have the Congress held not in Constantinople but in Ankara and when Yugoslavia extended an invitation to the International Society to hold the entire Congress in its country this was gratefully accepted. The Congress was to last not one week as it usually does, but two weeks, and was to travel through the chief centers of the country.

The charm of such international gatherings is not only that you meet your old friends and colleagues and have an opportunity to discuss your problems with them, but also that you visit new countries under most pleasant circumstances and—at reduced rates. The attraction, as a matter of fact, is such that many people who have no connections with medical history whatever, all of a sudden take a tremendous interest in the subject. The Madrid Congress was already crowded with such " tourists " and this year the International Society felt compelled to enforce Article III of its regulations according to which only members of the Society and residents of the country in which the Congress takes place are admitted to the meetings. The " tourists " therefore were cordially invited to become members of

the Society which did not make them historians but made them support a good cause by paying dues.

As a member of such a congress you also have the very pleasant feeling that you are travelling safely whatever your philosophy may be, a factor that must be considered when you are travelling in the very intolerant world of present Europe. You know that with three Russian visas in your passport you may be watched very closely, but will not be molested being a guest of the government. And indeed, the Yugoslavian government, the President of the Congress, Professor Lujo Thaller (Fig. 1) and his wife Madame Thaller were the most accomplished hosts. They were very ably assisted by the General Secretary, Dr. Vladimir Bazala (Fig. 2). The Congress had been prepared very carefully which was a difficult task in view of the unsettled political conditions in Europe last summer. Every possible privilege and courtesy were extended to us. Each member received a pass entitling him to free transportation in first class carriages on all Yugoslavian railroads. We received a similar pass for the street cars of Belgrade. The national government, governors of three provinces and mayors of four cities entertained us in the most magnificent way, and we only regretted that our gastro-intestinal tracts were not always up to the task. No effort was spared to make our visit as pleasant as possible and to show us the country in all its beauty.

Yugoslavia is a beautiful country indeed with its great rivers, its forests, and with its mountains—high peaks in the northwest, lovely hills in the central part and the bare rock of the Karst along the Adriatic. The population has still preserved its old customs, still wears its picturesque costumes. West and east meet in this country and give it a charm and a variety that is rarely found on such a relatively small territory. Yugoslavia no doubt is a paradise for tourists, and travelling is made easy through the travel bureau *Putnik*, an organization founded in 1923 which is partly owned by the state and partly by various tourist agencies. *Putnik* was in charge of transportation and the material side of the Congress, and solved its task as well as ever possible. It was not easy to satisfy 120 highly individualistic persons in a country in which hotels and other tourist facilities are still young.

As soon as I had heard that this year's Congress would be held in

Yugoslavia I had decided to attend it, not only because I was interested in these meetings but because I was most eager to visit the country and to have a glimpse of the public health work achieved there by Dr. A. Štampar who undoubtedly is one of the most powerful contemporary figures in the public health field.

I traveled to Yugoslavia from Switzerland through Italy on the Simplon-Orient Express and as soon as I emerged from the tunnel I noticed a huge inscription announcing Italy's creed: CREDERE—OBBEDIRE—COMBATTERE (to believe, to obey, to fight). This reminded me of another huge poster that the Germans had put up in Breisach on the Rhine facing France with their slogan: EIN VOLK—EIN REICH—EIN FÜHRER, whereupon the French had reciprocated with a poster of the same size announcing their creed: LIBERTÉ—ÉGALITÉ—FRATERNITÉ. These slogans illustrate better than anything else the present situation of Europe and the tension which must result when nations are forcing their creeds upon neighboring countries.

ZAGREB

The Congress convened at Zagreb, the capital of Croatia, the most progressive city of the country, beautifully located on hills. You met many old friends there: Victor Gomoiu (Fig. 3), Rumania's great surgeon and historian who has written a large number of monographs discussing all aspects of the history of Rumanian medicine, and his very charming wife Viorica Gomoiu, herself a very able surgeon and historian. Aldo Mieli (Fig. 4), Secretary of the International Academy of the History of Science, had come from Paris with galley proofs of a big history of Arabian science under his arm, on which he was working whenever the Congress gave him a minute's time. Davide Giordano (Fig. 5), former President of the International Society, former mayor of Venice, senator of Italy, surgeon and historian was there, one of the most pronounced personalities of the Society.

The size of the foreign delegations was determined by the influence foreign powers wanted to exert upon Yugoslavia. Germany therefore was at the top, having sent a large well-disciplined delegation with Paul Diepgen as *Führer* who represented not only the German Reich and the University of Berlin but the University of

Fig. 1.

LUJO THALLER.

President of the Congress.

Fig. 2.

VLADIMIR BAZALA.

General Secretary of the Congress.

Fig. 3.

VICTOR GOMOIU.

President of the International Society of the History of Medicine

Fig. 4.

ALDO MIELI.

Secretary of the International Academy of the History of Science (in the background Oskar Temkin)

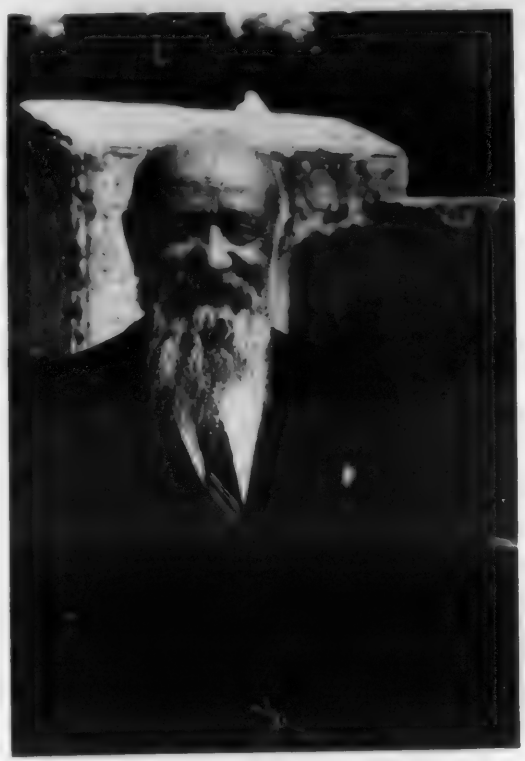

Fig. 5.

DAVIDE GIORDANO.

Former President of the International Society of the History of Medicine.

Fig. 6.

VALERIU BOLOGA.

Director of the Institute of the History of Medicine at the University of Cluj, Rumania.

Fig. 7.

JOSEPH TRICOT-ROYER.

Honorary President of the International Society of the History of Medicine

Fig. 8.

JOHN D. COMRIE.

Edinburgh

Vienna as well. Italy followed with a delegation of a dozen members and the Balkan countries were naturally strongly represented, Turkey first of all, where Ahmet Süheyl-Ünver is developing a very strong school of medical history. Many Rumanians were present and I was particularly pleased to meet Valeriu Bologa (Fig. 6), Director of the Institute of the History of Medicine at the University of Cluj, one of the most brilliant younger medical historians who can express himself with equal ease in at least a dozen languages. France was represented by Laignel-Lavastine, for many years General Secretary of the International Society and by Jules Guiart, its present Secretary. Tricot-Royer (Fig. 7), founder of the Society and its Honorary President had come from Belgium with a few colleagues. There was a small but choice delegation from the Scandinavian countries that was particularly popular for its lack of aggressiveness, O. T. Hult (Fig. 9) and Erik Waller (Fig. 10) from Sweden, Reichborn-Kjennerud (Fig. 11) from Oslo, Axel Hansen (Fig. 12) from Denmark. Dr. Waller, who has one of the most astounding medical history collections in the world never comes to a congress without some rare documents. This time he had not less than a whole volume of unpublished letters of Baglivi. Holland was represented by B. W. Th. Nuyens and van Gils who after Zagreb, however, both went their own ways.

Only two scholars had come from Great Britain Professor John D. Comrie (Fig. 8) of the University of Edinburgh and Dr. Robert Oswald Moon of London. America was represented by Capt. Frank Lester Pleadwell, the official delegate of the U. S. government and his charming wife Mrs. Pleadwell who disappointed our Croatian hosts because they had expected her, since she came from Honolulu, to appear in a grass skirt. Dr. Howard Dittrick represented our American Association of the History of Medicine and was accompanied by Mrs. Dittrick. Dr. Pan Codellas of San Francisco had joined the Congress after a long summer of research in Greece and O. Temkin and myself had come from Johns Hopkins (Fig. 13). Dr. Jabez H. Elliot (Fig. 15) was the only Canadian member present.

Other countries represented were Afghanistan, Czechoslovakia, Egypt, Hungary, Latvia, Lithuania, Poland, and Switzerland. The Soviet Union, Spain, and China were not represented and the

absence of delegations from these countries was generally regretted. The membership of the Congress amounted to about 120 including wives and children; the youngest member of the Congress was three years old.

It would be useless to deny that the political tension affected the meeting. The absence of some of the most prominent members of the Society became conspicuous at once. Professor Arturo Castiglioni, who had never missed a Congress and who was official representative of Italy in the Permanent Committee of the Society had been refused a passport by his government. The same had happened to Professor Max Neuburger whose seventieth birthday was to be celebrated formally at the Congress, and several other distinguished colleagues were missing who for racial reasons were not allowed to leave their countries. Until 1927 the Germans and their allies had been kept out of the International Society. We had struggled for years to have them admitted, and for the first time in Holland in 1927 the Society had become truly international and open to all scholars in the field. The Germans now are dominating the Society and racial prejudice is creating new antagonisms.

It was a most heterogeneous group that met in Zagreb on September 1 while war clouds were beginning to darken the horizon and a great deal of tact was required by everybody so as to preserve the harmony necessary for such a gathering.

In the afternoon of September 1 the Permanent Committee held a meeting which however was limited to routine business. Controversial subjects were carefully avoided so as to secure an auspicious beginning of the Congress. At 6 P. M. the delegates assembled in the beautiful building of the Croatian Medical Society to attend a lecture by Professor Gomoiu on his contribution to the surgery of the sympathetic nervous system, and a dinner at Hotel Esplanade concluded this preliminary day.

The formal opening of the Congress took place the following morning, September 2, in the old Parliament building where the one thousand year old Croatian Diet used to meet and where the independence of the country was proclaimed after the war. In elegant Latin Professor Thaller welcomed the representatives of the government and the foreign delegates. He was followed by Professor Albert Bazala, Honorary President of the Congress and President

Fig. 9.
O. T. Hult.

Fig. 10.
Erik Waller.

Delegates from Sweden.

Fig. 11.

INGJALD REICHBORN-KJENNERUD.

Delegate from Norway.

Fig. 12.

AXEL HANSEN.

Delegate from Denmark.

Fig. 13.

THE U. S. DELEGATION.

PAN S. CODELLAS, Mrs. and Dr. HOWARD DITTRICK,
Mrs. and Captain FRANK LESTER PLEADWELL,
OWSEI TEMKIN, HENRY E. SIGERIST.

Fig. 14.

Medal issued in memory of the Congress.

Fig. 15.
Jabez H. Elliot.

Fig. 16.
Jules Guiart
Aldo Mieli
Davide Giordano
M. Laignel-Lavastine

of the Yugoslavian Academy of Arts and Sciences who stressed the importance of historical studies. Professor Victor Gomoiu then followed, expressing all our appreciation of the hospitality extended to us by the Yugoslavian government and scientists, and a short address by Dr. Katičić, head of the division of medical history of the Croatian Medical Society, concluded the formal opening exercise.

The Congress then began its work and devoted the morning session to a discussion of *Mysticism in Medical Folklore*. Professor Albert Bazala gave an introductory lecture in which he developed the part played by mysticism in the history of civilization. A number of papers pertaining to the subject were read. Dr. Temkin discussed Demonology and the Medical Tradition of the Middle Ages, and Dr. Pan S. Codellas of San Francisco spoke on " The Smerdaki, General Remarks on the Medical Folklore of Modern Greece in Relation with the Origin and Prevalence of the Smerdaki." Throughout the Congress German was the dominating language not only on account of the strong German delegation but because German is the language most familiar to the Croatian colleagues. A number of members, notably from Rumania and Turkey, had printed their papers in advance and in such cases papers were not read but distributed which saved a great deal of time.

After a luncheon tendered by the mayor of Zagreb the members of the Congress visited various departments of the Medical School, and the Institute of Hygiene. Higher education in Croatia can be traced back to the 17th century.[2] In 1607 the Jesuits organized a college in Zagreb. In 1662 they established a philosophical faculty and thus became the founders of the Academy of Science which was chartered in 1669. From the end of the 18th century on the Academy repeatedly requested the government to found a medical school which seemed highly desirable for improving the conditions of public health. In 1811 a Zagreb physician Rudolph Lamprecht founded a private school of surgery in one of the hospitals (Zakladna Bolnica) but it was only short-lived. In 1840, 1843, and 1845 the Croatian Diet and in 1850 the Medical Society of Zagreb petitioned the government to establish a medical school, but always in

[2] Vladimir Ćepulić, *Medicinski Fakultet u Zagrebu i Nastojanja Oko Njegovog Osnivanja s Osobitim Obzirom na Ulogu Zbora Liječnika*, Zagreb, 1938.

vain. In 1861 after the downfall of absolutism in the Austro-Hungarian Empire the Diet wished the Academy to become a university to which a medical faculty was to be added, but the Crown declared that a university in Croatia would not have enough students nor the funds to support it—whereupon funds were raised in the country. But it was only in 1874 that the University was founded at last, however without medical faculty. Again funds were raised and during the war in 1917 without waiting for the Royal approbation the university began to admit medical students, even before professors had been appointed. Courses were given by professors of the Faculty of Science. The government was finally compelled to give in and the first appointments to medical chairs were made in April 1918. During the academic year 1936-1937 796 students were registered in the Medical Faculty and at the end of that year the school had trained over a thousand physicians.

The University of Belgrade was founded in 1905. A medical faculty was planned but could not be organized before 1919. In Ljubljana, the capital of Slovenia, a university with medical faculty was established by Napoleon in 1800 but broke down after a few years in 1814 when he had lost Illyria. The new university of 1919 has a medical faculty which however is not complete and trains students only in the basic sciences.[8]

The day of September 3 began with a visit to various cultural institutions of the city such as the University Library, the Academy of Science, and the Cathedral. The high spots of the morning were a visit to the Ethnographical Museum, a unique collection of Yugoslavian folklore that gives a most impressive picture of the rich artistic life of the peasantry—and a visit to the Natural History Museum where Professor Zarnik reported on the excavations of Krapina.

After a luncheon offered by Professor Thaller in the Hospital of the Sisters of Mercy, his chief field of activity, the scientific sessions were resumed and the subject on the program was "*Science in Popular Medicine* (*Plants, Animals, and Minerals*)." Professor

[8] Djordje Kovačević, *Historische Darstellung der Sanitätsverhältnisse der jugoslawischen Provinzen in ihrer Beziehung zur Gründung der medizinischen Fakultäten*, Inaug.-Diss., München, 1938.

Castiglioni was to give the introductory address and in his absence Professor E. Starkenstein spoke and made some very pertinent remarks to the subject. He warned against over-estimation of the drug lore of primitives. Popular medicine knows many herbs, but hardly ever indicates the dosage or the time when a drug should be applied. Popular healers sometimes have the reputation of being able to resuscitate the dead, a reputation which they obviously acquire by giving analeptic remedies to patients who had merely fainted. Throughout the afternoon a large number of papers were read on this particular subject and the day ended with a concert in the open air in front of the cathedral and a brilliant reception at the Governor's palace. The day was spoiled however by news that had just come from Italy. The anti-Jewish decrees had been published which would throw over 170 university people out of office. Needless to say that there was general consternation among all democratic members of the Congress.

September 4 was a Sunday. A morning session was held in the lecture hall of the School of Veterinary Medicine and was devoted to problems of *Teaching and Study of Medical History in various countries.* Professor Wladislaw Szumowski, Director of the Institute of the History of Medicine at the University of Krakow, gave a very illuminating report on conditions in Poland where medical history has been given a definite place in the curriculum of all the medical schools.[4] In Poland the final medical examination does not give the candidate the title of Doctor of Medicine, but merely the license to practice. If a physician wishes to become a Doctor (which means: a scholar) he must submit a dissertation and must pass an examination in the history and in the philosophy of medicine.

Professor Victor Gomoiu gave a comprehensive report on the status of medical history in the various countries based upon a questionnaire that he had sent out to the national delegates a year ago. I am afraid that his report gave a far too optimistic picture because he did not differentiate between full professorships and honorary chairs and we know all too well that many universities throughout the world claim that they are teaching history of medi-

[4] W. Szumowski, *L'Histoire de la Médecine et les Doctorats en Médecine*, Cracovie, 1938.

cine while it actually is done very often in the most inadequate way. No formal resolution about the necessity of teaching medical history was passed as had been done repeatedly in previous years. It is not resolutions that will introduce the subject into the medical curriculum but the example we set in our work. If we can demonstrate convincingly the value of medico-historical studies I have no doubt that they will become a recognized subject. If we fail, however, no resolution in the world will have the slightest effect.

Several short papers followed the two principal reports. Professor Bologa gave a description of the Institute that he is directing at Cluj, and Professor Comrie told us about conditions in Edinburgh where a medal is being given every year to the student who has written the best essay in a contest. The session was brief because at 12:55 we left Zagreb for Belgrade.

The Social and Economic Structure of Yugoslavia

The public health situation of Yugoslavia is determined, like everywhere, by the social and economic structure of the country, and the most characteristic feature is that this is an agrarian country and that its population is immensely poor. Eighty per cent. of the 15 million population consists of peasants who live in villages. They were serfs until 1848. They were liberated then but had no land and were obliged to work on the large estates of a landed gentry, aristocratic families many of which were foreign, Hungarian or Austrian. After the World War the Kingdom of the Serbs, Croats, and Slovenes was founded. The peasants wanted land and when a revolt was threatening a Land Reform Act was passed. Many large estates were broken up; two and a half million hectares [5] were expropriated, and the owners were compensated in bonds. This land was distributed among 637,328 peasant families.[6] It was something but not enough. It was less than 4 hectares of not always fertile soil per family, and it has been estimated that one hectare of cultivated land is the minimum required for the subsistence of one individual. The farming methods are very often primitive, and

[5] One hectare is equal to 2.471 acres.

[6] These and the following figures, unless other sources are mentioned, are taken from: *La Yougoslavie par les Chiffres*, Beograd, 1937, Bureau Central de Presse.

production per hectare is less than in most western countries. The distribution of land and the fertility of the soil are quite uneven. Ninety-five per cent. of all peasant families possess less than half and 5 per cent. somewhat over half of the cultivated soil.[7] 76,419 peasant families have no house of their own; 173,337 have no land; 534,012 no stock.[8] In the Vojvodina, the province bordering Hungary, the soil is fertile and the peasants are either Kulaks or extremely poor farm laborers. In Bosnia the peasants grow excellent tobacco, but tobacco is a state monopoly. Production is controlled and crops are purchased by the state at a low price set by the state which makes tremendous profits on tobacco. The best conditions are found in Slovenia where the population has the highest educational level of the country, where the church is powerful and works with the people, and where the officials are Slovenians. It is the rare case of a minority that is better off because it has its own language. The Croatians and Serbs speak the same tongue and as a result the central government is able to send Serbian officials to Croatia who oppress the people and are utterly unpopular. In Dalmatia the soil is almost bare rock and the population is extremely poor. A peasant will not hesitate to walk six hours in order to sell half a dozen eggs.

The economic depression has hit the people very severely. Income from agriculture dropped from 1926 to 1936 from 36 to 21 billion dinars.[9] The average peasant lives on corn bread and beans and sells his other products, milk, eggs, poultry, meat to the cities in order to be able to pay taxes and to buy the barest necessities. Much of these agricultural goods is exported, notably to Germany that pays for them in machines and other commodities which do not benefit the peasant.

The situation of the industrial worker is hardly any better. The chief industries are food industry, textile, lumber, mining, and iron industries. The country is extremely wealthy in natural resources,

[7] Andrija Štampar, Observations of a Rural Health Worker, *The New England Journal of Medicine*, Vol. 218, No. 24, pp. 991-997, June 16, 1938.

[8] A. Štampar, *Public Health in Jugoslavia*, School of Slavonic and East European Studies in the University of London, 1938, p. 11.

[9] One dinar is about 2 American cents.

many of which have not been exploited yet. Over 50 per cent. of the capital invested in industry is foreign so that the surplus values created by the Yugoslavian worker do not benefit the nation. Germany is beginning to dominate the country economically. In 1936 37 per cent. of the total imports were from and 38.4 per cent. of the exports went to Germany and Austria, and the percentage has increased considerably since. The fate of Yugoslavia, like that of other Balkan countries, is to become an economic vassal of the Third Reich.

The industrial population is not large. In 1936 the social insurance offices registered 741,713 industrial workers. In that year the average wage amounted to 20 dinars a day, which is about 40 cents, very little in a country where life is definitely expensive. Over 100,000 workers earned less than 10 dinars a day, or about 20 cents. And there is a tremendous turn-over of labor, the average worker changing his job five times a year. No wonder that in 1936 there were not less than 400 labor conflicts and 275 strikes.

Education has progressed but is still at a rather low level. In 1931 the country still had 44.6 per cent. illiterates. There are provinces where over 70 per cent. of the population can neither read nor write, and in 5 provinces 80 per cent. of all women are illiterate. In the Soviet Union illiteracy in less than 20 years was reduced from 70 to less than 10 per cent. This was possible because the Soviet Union has a government of the people, for the people, because it wants to be a democracy as soon as ever feasible, and therefore needs an educated population, able to take an active part in government.

In Yugoslavia there is a definite antagonism between ruler and ruled. The State was founded as a constitutional monarchy with a parliamentary system. In 1929 however Parliament was dissolved, the Constitution was abolished and the King made himself a new Constitution. There is a Parliament again today but elections are by open ballot under police supervision and the results can be interpreted the way it pleases the government. Yugoslavia today is a virtual dictatorship, not of one man (the present King is a minor still) but of a few men, and the population is constantly watched and spied upon by an enormous police force.

It is obvious that under such conditions the prevalence of disease is still high and that public health services are facing a very difficult

task. The occurrence of some contagious diseases is illustrated by the following figures:[10]

	1934	1935
Typhus	2210	683
Typhoid	7805	5142
Diphtheria	11606	7892
Dysentery	3393	3141
Erysipelas	2134	2561
Anthrax	718	788
Rabies	15	20

Malaria is endemic in the eastern section of the country and the government policy according to which soldiers are shifted from one province to another contributes to the spreading of the disease. Trachoma still occurs as a result of the low standard of living of certain regions. Venereal diseases are endemic in Bosnia and are very widespread in the cities. Brothels have been closed but the causes of prostitution have not been removed. Poverty of the villages compels the surplus population to migrate to the cities where the young people are very much exposed to contamination.

Yugoslavia has one of the highest European death rates: 17 for 1000 population in 1934, a figure that was surpassed only by Rumania (20.7). Infant mortality is equally high: 150 per 1000 live births in 1934 (Rumania 182, Lithuania 166). The birth rate is high and amounted to 31.4 per 1000 inhabitants in 1934.[10]

Widespread superstitions create more handicaps to public health work. In the Mohammedan section of the country the ancient ideas of purity, familiar to us from Leviticus, are still alive. A woman in childbirth is unclean and is therefore not allowed to bear child in the house. As she is too poor to go to a hospital and as not enough hospital facilities are available she goes to the stable and bears her child among sheep and goats with the result that infections are not infrequent. In Dalmatian villages the idea is often met with that a new-born child is not to be taken out of the house before it has been baptized. The underlying idea probably is that inside the house the unbaptized child still is protected by the holy images that

[10] League of Nations, Health Organization, Annual Epidemiological Report . . . for the year 1935, Geneva, 1937.

every peasant house contains, while outside the house it would be a target for evil spirits unless it had been baptized. Custom however requires that the father be present at the ceremony, and as many Dalmatians are sailors it may be months before the baptism can take place. During all that time the infant remains in the unventilated room and when it is finally brought into the open air it often happens that the child catches pneumonia and dies within a few days.

In spite of all these gigantic handicaps the fight against disease has been taken up in Yugoslavia with great energy as will be described in following chapters.

Belgrade

It was late evening when our train approached the capital. We crossed the Sava and the city was in front of us illuminated by millions of lights. Belgrade is a beautiful city with a unique location on the banks of two mighty rivers, the Danube and Sava. Old quarters have still been preserved. The minaret of a mosque is a last reminder of the period of Turkish domination and a small inconspicuous two-story building was the seat of the Serbian University in Turkish days. The city suffered a great deal during the World War when it was bombed repeatedly and the Germans removed the last scrap of metal they could find. The general impression today, therefore, is that of a new city with many large modern buildings, many of them in excellent style.

There is much rivalry between the capitals of Croatia and Serbia, a competition by which our Congress greatly benefited. We had been received in the most lavish way in Zagreb and it was obvious that Belgrade would not stay behind but on the contrary try to surpass Zagreb. We therefore were invited to one banquet after another, and to endless entertainments until after four days spent in Belgrade most of us were complete wrecks. There was again a formal opening session, in the great hall of the University under the presidency of Professor Alexander Belić, President of the Serbian Academy of Sciences. Formal addresses were presented by members of the authorities and officers of the International Society. Two subjects were on the program of the scientific sessions of the day: *Medicine in Popular Poetry* and *Medicine in Yugoslavia*. I was

particularly interested in the latter subject because I knew very little about it.

The history of medicine in the territory of present Yugoslavia can be divided into four periods. The Romans dominated the country for four centuries, the eastern section being part of the province Pannonia, the western of Illyria. The physicians of that period were Roman army physicians and two graves of such army doctors have been excavated. Medical instruments have been found, and wherever the Romans went they established public health institutions such as water supplies and thermae. In the second or mediaeval period the Serbian kings and princes had court physicians, some of whom were Italian, while others were natives of the country. The first Slavic medical book was written in the fourteenth century and is now preserved in Prague. Seven hospitals are recorded which were either in monasteries or not far from them. Two leprosaria were established in Zagreb during that period. Ragusa is particularly rich in medical records. As early as 1281 the city had appointed two doctors whose number was increased to four and finally six. A pharmacy was built in 1272 and in 1377 Ragusa was the first city to establish a quarantine. Venetian, Turkish, and German or rather Austrian influence dominated the third period and a new period was entered upon early in the nineteenth century when Serbia and Montenegro regained their independence.[11]

There was a strong health movement in Croatia as well as Serbia long before the War, somewhat similar to the one observed in Russia at that time. The conditions were very much the same, both countries being primarily agricultural countries. The Yugoslavian lands, however, did not succeed in establishing a system comparable to Russian Zemstvo medicine, but the need for it was felt and it was recognized that the protection of health is a concern of government. The great pioneers in this movement were Dr. Vladan Djordjević, and Milan Jovanović Batut, the latter still alive in his nineties today and a member of the honorary committee of our Congress.

[11] Risto Jeremić, Brevis Conspectus Historiae Culturae Sanitariae in Jugoslavia, *Medicinski Pregled*, 1938, Vol. XIII, pp. 160-162. The whole number of this journal is devoted to the history of Yugoslavian medicine.—*Extraits de Travaux sur l'Histoire de la Culture Sanitaire de la Yougoslavie et de la Peninsule Balkanique*, édités par l'Institut Central d'Hygiène, Beograd, 1934-1938.

September 6 was entirely devoted to the celebration of the 15th birthday of King Peter. The evening before we saw a torchlight parade in the streets of Belgrade. On the morning of September 6 we were the guests of the government at a military parade in Banjica. I was less impressed by the mechanized section of the army or the colorful cavalry than by the infantrymen, small but sturdy fellows who have earned a great reputation for the Serbian army in many wars. After the parade the Congress went to the tomb of the Unknown Soldier in Avala, a simple dignified monument in black marble, the work of Meštrović, undoubtedly one of the most powerful sculptors of our time, a man who does not belong to Yugoslavia alone but to the world at large. The monument has a beautiful location on top of a steep hill. After lunch a group of Congress members drove to Oplenac to deposit a wreath at the tomb of King Alexander. He is buried with the other members of his family in a mausoleum decorated with mosaics in Byzantine style in a valley where the family had its holdings. The dynasty of the Karadjordjević was always proud of its peasant origin. In the evening we were invited to the Officers' Ball, one of the great social events of the Belgrade season. It was a very formal and colorful affair with the men in great uniforms and the ladies in court gowns, dancing not only fox trot and tango, but also Viennese waltzes and Serbian kolo.

The morning session of September 7 was devoted to a discussion of the *History of Malaria* and half a dozen papers were read or presented in print. A lunch was offered on a Danube boat while we sailed down the river to Smederevo, an old town famous for its excellent wine that compares favorably with some of the best Rhine wines. We were welcomed by the mayor, himself a doctor, who conducted us to the ruins of an old fortress, once the stronghold of a Serbian baron who had complete control over the Danube and terrorized the population of the region. The day ended with an excellent performance of Musorgski's opera "The Fair of Sorochina" in the National Theatre.

September 8 was our last day in Belgrade. In the morning session papers on various subjects were read. It would be too long to list them but they covered a very wide range of interests. In the afternoon the official part of the Congress came to an end. More speeches

were made, Gomoiu and Thaller kissed each other and everybody was moved. The Minister of Social Welfare and Public Health had invited us to a banquet tendered by the government and once more we tasted the excellent fogas and the Yugoslavian poultry that has no equal in the world.

Public Health Administration

The kingdom of Yugoslavia was founded on December 1, 1918 and in 1919 a Ministry of Public Health was established whose work was supplemented by a Ministry of Social Welfare. As both agencies were serving the same purpose they were amalgamated in 1929 to form a single Ministry of Public Health and Social Welfare. Immediately attached to the Ministry as its chief research laboratories and advisory bodies are two great institutions that have jurisdiction over the whole country namely, the *School of Public Health in Zagreb* and the *Central Institute of Health in Belgrade*.[12]

Since 1929 the country is divided in nine provinces (*banovinas*) to which the capital Belgrade has been added as an administrative unit of its own. At the head of each province is a governor (*ban*) who is nominated by the central government and is assisted by a provincial council whose members are equally nominated. The governor administers his province through departments, one of which is the Department of Social Welfare and Public Health. Each province has an Institute of Health which represents the highest authority in health matters in the territory. Within the province cities of more than 4000 and villages of more than 6000 inhabitants constitute public health administrative districts and smaller villages combine to form such districts whose population is not to exceed 15,000 inhabitants. Public health is administered in these districts by Health Centres which are under the control of the provincial Institutes of Health and are operated by the local district doctors and parish medical officers. There are 48 Health Centres and 123 Rural Health Centres today and if one adds the various tuberculosis

[12] See A. Štampar, *Organisation of the Public Health Services in the Kingdom of the Serbs, Croats and Slovenes*, League of Nations, Health Organization, C. H. 326 (1925), 51 pp.—A. Štampar, *Public Health in Jugoslavia*, London, 1938. B. Konstantinović, *La Yougoslavie pour la Santé Publique*, Beograd, 1937.

and venereal disease stations, school clinics and other similar institutions, there are today 300 state medical institutions scattered all over the country to protect the people's health.

Hospital facilities have been greatly developed. The majority of all hospitals are owned and operated by the state (157 state hospitals with 25,327 beds as compared with 35 private hospitals with 2,061 beds, in 1936). The total number of beds available is 27,388 or 1 to every 547 population (in the U. S. 1 to 137) to which 3,171 beds in state and private sanatoriums must be added.

The number of physicians has increased but is still relatively small. In 1936 the country had 5,630 doctors or 1 for every 2,660 population (in the U. S. 1 to 760). The doctors are very well trained in five-year courses supplemented by a practical year, six months of which are devoted to curative and six months to preventive medicine. This emphasis on the preventive aspect of medicine is excellent. An additional training of at least three years and a special examination is required for all those doctors who want to become specialists or to hold responsible positions in any state institution of health. As the country is poor the doctors could not make a living in private practice and the majority of the population could not get any medical service if it had to purchase it from private physicians. Over 3,600 doctors have salaried positions in the government service but salaries are small so that most doctors must make an additional income through private practice, a combination that is never good. Štampar is certainly correct when he states that " the day of the private doctor is over " and there can be no doubt that medicine is socialized to a very large extent in Yugoslavia. The better developed and the more progressive a province is, the more medicine is socialized, and Slovenia that has the smallest percentage of illiteracy has an almost complete system of state medicine.

Sarajevo

After the tension of the days spent in Zagreb and Belgrade we felt very much relieved when we boarded the train for Sarajevo in the morning of September 9. It was a superb ride through the mountains, through wild gorges and through endless tunnels, and all of a sudden toward evening we entered an enchanted world. All of

a sudden we were in the middle of the Orient: slender minarets wherever we looked, cemeteries all over with those queer turban-shaped tomb stones, veiled women, a real Oriental bazaar. The population of Bosnia is not Turkish but Croatian and Serbian. Only the upper class consisted of Turks who withdrew to the east when Turkish domination came to an end in 1878. But the population had become Mohammedan, had adopted Turkish customs, and has preserved them to our days while Turkey was modernized.

The official part of the Congress had come to an end. There were no more papers to listen to, we could relax and live and act as tourists. September 10 was devoted to sight-seeing. We crossed the bridge over the Miljačka and came to the place where the first shot of the World War was fired, where the death sentence of 10 million people was pronounced. When we stood there Germany had already mobilized half a million people, France had decreed partial mobilization, and war clouds were darkening the horizon again. We visited mosques and beautiful Turkish houses and felt transplanted into the world of the Arabian Nights. We saw a rug factory where highly skilled women laborers work for shockingly low wages. We were received in the most gracious way by the mayor of the city. We drove to the surrounding hills where the view of the city and of the Balkan mountains is overwhelming. Some members of our Congress could not resist the temptation to "go native." They bought fezes and looked quite genuine (Fig. 16). In the late afternoon some of us drove to a hill which is dotted with gigantic tombstones of the Bogomili (Fig. 18), an old Christian sect that came from Asia Minor in the 12th century and played an important part in the history of Bosnia. The tombs were respected throughout the centuries because it was known that they contained no riches. Late at night some of us went for a long walk all through the city. The full moon was shining and Turkish beaux were serenading their belles.

September 11 was a Sunday. We went to visit the leprosarium where about a dozen patients are hospitalized. Then we called at the palace of the Vice-Governor of the province where again we were received in the most cordial way (Fig. 17). The afternoon was free and toward evening we gathered in Ilidza, a health resort not far from Sarajevo with a powerful sulphur spring. A banquet was

tendered to us there by the Vice-Governor with the local doctors and health officers.

Although the days spent in Sarajevo were mostly devoted to sight-seeing, the Congress yet had a very important item on its program, namely the chief session of the Permanent Committee. It was held in the City Hall on September 10. The national delegates and officers convened to decide on future policies of the Society. While all controversial questions had been carefully removed from the first meeting in Zagreb, now they had to be discussed. The chief such question was in what country the next congress should be held. Ever since 1927 Germany had been a candidate and the Society had always desired to honor Karl Sudhoff by having the congress held in his country under his presidency. But then the Nazis came into power and at Madrid it was felt that the atmosphere of the Third Reich would not be favorable for such a meeting. Since Madrid, however, German power had increased so tremendously that without any formal vote the Permanent Committee decided to accept an invitation of Germany and to hold the next Congress under the presidency of Professor Paul Diepgen in Berlin where as Professor Diepgen said, the achievements of the Third Reich could be demonstrated most convincingly. There was no chance for any dissenting vote. And as soon as Berlin had been accepted the Italian delegate popped up and invited the Society to hold its second next Congress in Rome in 1942 when a World Fair would take place in the Italian capital. Some delegates voiced the view that a World Fair was a good reason to avoid a city, but their objections were easily overridden and the Italian invitation was accepted. And as the Rome Congress will be held in 1942, the Berlin Congress will take place in 1940, that is in two years instead of three. In other words, the next two International Congresses of the History of Medicine will be held in Fascist countries so that the Jewish members of the International Society will be barred from its activities until 1945. Not officially, of course, because they undoubtedly will be invited to attend the meetings, but no Jewish scholar who has any self-respect can possibly accept the hospitality of a government that considers him a low species of ape and persecutes his race in such a barbaric way.

The situation is most deplorable and I am convinced that if any

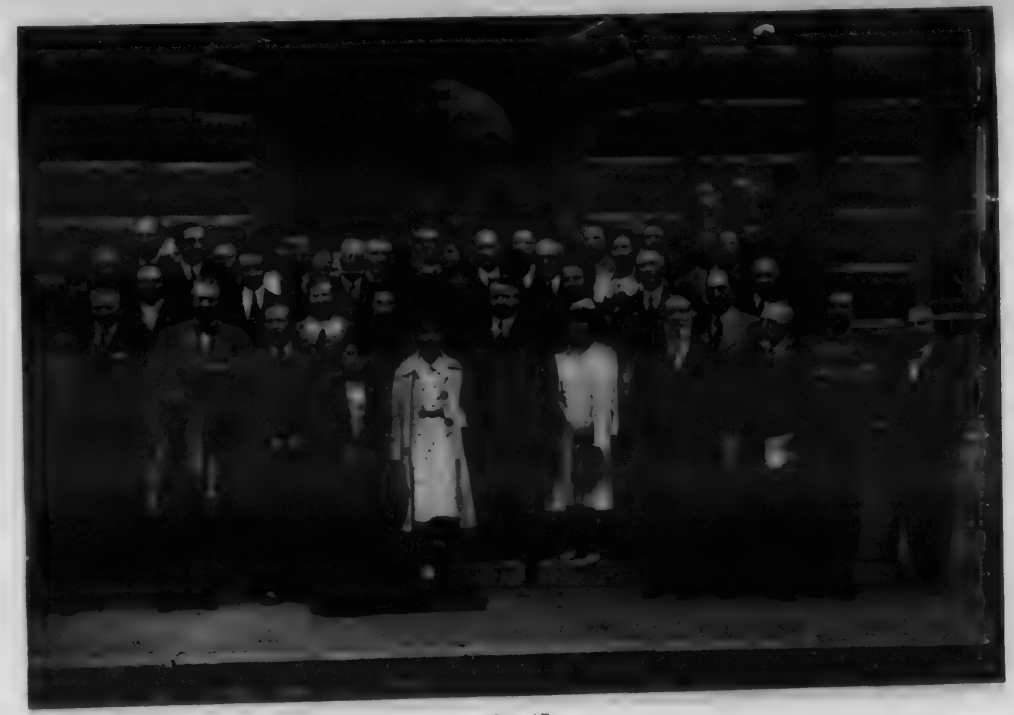

Fig. 17.

Members of the Congress in front of the Governor's Palace in Sarajevo.

Fig. 18.

LUJO THALLER.
in front of a tombstone of the Bogomili.

Fig. 19.

The Island near Dubrovnik on which the first quarantine was established.

democratic country had extended an invitation the Permanent Committee would have considered it with enthusiasm, but there was no such invitation. The aggressive nations today are the Fascist countries and it is not in the traditions of liberalism to use science and learning for purposes of national propaganda. As things now stand the next two Congresses are going to be tremendous political demonstrations for which the Ministries of Propaganda of the respective countries will spend enormous amounts of money. Respected members of our Society however like Max Neuburger, Charles Singer, Arturo Castiglioni, Aldo Mieli, and so many others will not be able to attend them, and I know that many liberal members of the Society will stay away also. And so the International Society is again dominated by political considerations, in an infinitely worse manner than before 1927.

To counterbalance the evil impression of these decisions the Permanent Committee elected Max Neuburger, Charles Singer, and Karl Sudhoff as Honorary Members. Henry E. Sigerist was elected a Vice-President. A committee was appointed for the study of medical folklore and another committee to decide on questions of priority. The latter needs an explanation. Should there be controversies, as frequently happens, about the priority of a discovery, the committee with the help of specialists would try to settle the question by approaching it with all methods of critical historical investigation.

It then was decided to have the following questions studied and discussed at the Berlin meeting: 1. Methods of teaching medical history. 2. Medical history in a definite period in various countries. 3. The history of typhus. When the meeting adjourned many delegates left with the impression that the International Society had entered a critical period of its history.

Social Insurance

Austria and Hungary were the first countries to adopt social insurance after Germany and therefore the formerly Austrian sections of Yugoslavia, Slovenia and Dalmatia, had a system of accident insurance since 1887 and of sickness insurance since 1888. The formerly Hungarian sections, Croatia and part of the Vojvodina,

had sickness insurance since 1891 and accident insurance since 1907. Social insurance was introduced into Bosnia and the Hercegovina in 1909, and in 1910 Serbia intended to introduce some insurance scheme but was prevented from doing so by the wars.

Social insurance legislation for the kingdom of Yugoslavia was passed in 1922 and was repeatedly amended and extended in the following years. Today it is one of the most modern and comprehensive insurance schemes.[18] It includes three groups: 1. Sickness insurance. 2. Accident insurance. 3. Insurance in case of disablement, old age and death. The latter group was added by legislation of 1937.

The Social Insurance Fund is an autonomous organization with central administration in Zagreb and 17 local offices to which 3 small special offices are added for the insurance of employees in stores. The organization is under control of the Ministry of Public Health and Social Welfare but is autonomous otherwise and has its own arbitration courts.

Who is insured? All wage earners and salaried employees regardless of sex, age and nationality and regardless of the amount of income. For all these groups social insurance is compulsory and the benefits are extended without additional premium to all family members whether legitimate or illegitimate.

Not yet included are: 1. Agricultural workers and servants, but insurance benefits are extended to them when they attend threshing and other agricultural machines. 2. Persons temporarily employed in household service. 3. Fishermen at sea. Government employees have benefits equal to those of insured persons, and transport workers and miners have their own insurance funds controlled by their respective ministries. In 1936 an average of over 600,000 workers were insured.

What are the benefits? The benefits consist of services and indemnities. Sickness insurance guarantees complete medical service and maternity care including free medical treatment, assistance by a midwife and if necessary by an obstetrician, free medicines and appliances, hospitalization in public hospitals, treatment in health resorts and sanatoria, and also dental treatment. For the latter however a special charge is made. These benefits are extended for a

[18] Social Insurance in Yugoslavia, *Report of the Central National Health Insurance Office in Zagreb, 1922-1926*, Zagreb, 1929. *Workmen Insurance in the Kingdom of Yugoslavia*, Zagreb, 1937.

period up to 26 weeks which may be extended to 52 weeks. If a case of illness lasts longer the patient falls under Invalidity Insurance. Medical care is given through excellent health centres which in 1936 employed 1182 general practitioners, 213 specialists and 334 dentists. 269 physicians are full-time employees, the others are engaged on terms of collective contract. The social insurance organization owns and operates 140 dispensaries and 26 sanatoria and convalescent homes. Patients are hospitalized in public hospitals at the expense of the Insurance Fund. There is no free choice of physician and there is no reason why there should be.

In addition to these services sickness benefit amounting to as much as two-thirds of the wages is paid up to 26 weeks and may be extended to 52 weeks.

In case of childbirth a maternity benefit to the extent of two-thirds of the wages is paid for six weeks before and six weeks after delivery and in addition a bonus of 150 dinars is paid in each case of delivery and 4 dinars a day for nursing when maternity benefit ceases. In case of accidents the allowance paid to the insured worker may amount to as much as 100 per cent. of the wages. Old age pension is granted after 70 years of age.

What is the cost of social insurance? Premiums for sickness, invalidity, old age and death insurance are contributed by employers and employees in equal amounts; for accident insurance by employers alone. The total amounts to about 10 per cent. of the wage bill. The workers are divided into twelve wage groups according to which the premium is determined. The employee's contribution is deducted from wages.

Unemployment insurance is not part of the general scheme but is provided through the Labor Exchanges.

There can be no doubt that social legislation has reached a high level in Yugoslavia. I visited several health centres and sanatoria operated by social insurance funds, and found them the most modern medical institutions in the country, well equipped and well staffed.

Dubrovnik

The Congress left Sarajevo on September 12 and on the way to Dubrovnik our special train stopped for an hour at Mostar, an Oriental-looking city with a famous " Roman bridge " which how-

ever was built by a Renaissance architect. It is a dreamy town with craftsmen working in their open shops, and the most modern building of the place, symbol of a new time, is the Health Centre of the Social Insurance Organization.

We reached Dubrovnik in the evening, just in time to hear Hitler's violent speech claiming the Sudetenland for Germany, and the ominous " Siegheils " of his followers. The situation had become extremely tense all over Europe; nervousness was growing daily in Czechoslovakia. Incidents had occurred in the last few days and Hitler's speech that openly advocated violence made the war clouds still darker.

Dubrovnik was crowded with German tourists and it was impossible to house the members of the Congress in one section of the city, so that we were scattered in pensions all over the neighborhood and communication between the various groups became very difficult. We all came together however for one more formal exercise on the morning of September 13 to celebrate the memory of one of Dubrovnik's great sons *Giorgio Baglivi*. We met in the hall of the Officers' Casino. Professor Pietro Capparoni held the chair. Professor Diepgen, who was to make an address on " Physical Thought in the History of Medicine " had given his talk in Zagreb already as he had to leave the Congress early to be in time for the meeting of the German Society of the History of Medicine, Science and Technology. The Curator of the Biblioteca Lancisiana in Rome, Dr. Alessandro Canezza, gave a flowery address in elegant Latin. I then read a paper on " Baglivi and the Iatromechanical Doctrine " in which I tried to show that Baglivi represents the peak and at the same time the breaking point of the iatromechanical school. In his physiology and pathology Baglivi is an orthodox follower of the school, while in his practice he forgets his theories and calls himself a follower of Hippocrates. In other words, a point had been reached at which theory and practice did no longer conform but went their own ways. Dr. Erik Waller demonstrated his unique collection of letters of Baglivi, and Professor Lujo Thaller gave the final address of the Congress by discussing the philosophic foundations of Baglivi's medicine.

Although Baglivi left Ragusa when he was a young child he always felt attached to the city in which he was born on September 8,

1668 *pulcherrima et nobilissima Dalmatiae urbe*. And indeed Ragusa was a unique city, beautifully built on a rocky peninsula surrounded by walls that remind you of Avignon or Carcassone—a most picturesque city today still. Founded by refugees from the Graeco-Roman colony of Epidauros (Cavtat today) who in the 7th century were driven away by the Avars, it increased its population with the immigration of Slavs and soon became one of the most prosperous merchant cities of the Adriatic. Although surrounded by powerful and greedy neighbors, Venice, Hungary, and Turkey the city state of Ragusa succeeded through clever negotiations in preserving its independence for a thousand years. It reached the height of its prosperity during the Renaissance and became a cultural center in which Romance and Slav civilization were blended in the best possible way. During the Napoleonic wars Ragusa, like Venice, lost its independence, and the Congress of Vienna made Dalmatia part of the Austrian Empire.

In the afternoon the members of the Congress sailed to Cavtat, the birthplace of Ragusa, passing the island Mercana (Fig. 19) on which the first quarantine was established in 1377. On July 27 of that year the city council had ordered that all travellers coming from plague-ridden countries should be barred from the city unless they had spent one month on the island *ad purgandum*. Cavtat was founded in 590 B. C. by Corinthians and was given the name Epidauros. It became the seat of a healing cult and there is still a cave which according to traditions was a sanctuary of Aesculapius. It is needless to say that we visited it (Fig. 20), but we found neither the god nor his serpent. We also visited a mausoleum which contains some of Meštrović's best creations and we were offered a tea by Mrs. Pava Račić-Pasić.

September 14 was the last day of the Congress with a visit to the Archives and an excursion to the island of Lokrum on the program, but war seemed so close that most members of the Congress hastened to get home. New incidents had occurred in Czechoslovakia, the Sudetens had repudiated the Carlsbad program and were asking for a plebiscite. They had sent an ultimatum to Prague. Czech gendarmes had been killed in the Sudeten area and it looked on the surface as if war could break out at any time. The boat that sailed from Dubrovnik to Split was therefore crowded with medical historians.

Health Cooperatives

The idea to extend the principles of cooperation to the protection of health materialized in Yugoslavia earlier than in other countries. It found a fervent advocate in Dr. Gavrilo Kojić (1890-1927) who organized the first Health Cooperative in 1921.[14] His guiding idea was that a private cooperative organization would have a stronger appeal to the peasant than a government service and would encourage him to take an active part in the health work of his community. It was the correct idea that the protection of the people's health is the concern of the people themselves. The cautious peasant sees in the government primarily the tax collector and believes that nothing good can be expected from it, while the Cooperative is the peasant's own affair. Dr. Kojić moreover thought that there would be less bureaucracy in a private than in a state service.

The Health Cooperatives own and operate their own Health Centres. They perform curative and preventive work and give a large amount of health education. They endeavor to improve the sanitary conditions of the village in association with the provincial Institutes of Health and they have been empowered by law to perform the functions of the parish health councils. They are all affiliated with a Central Union of Health Cooperatives. They are not self-supporting, but require state subsidies and they have been helped repeatedly with American money, particularly from the Milbank Fund. The Cooperatives grew slowly but steadily as illustrated by the following figures:

	1925	1931	1936
Number of Health Cooperatives	21	67	115
Number of members	8,386	28,387	57,450
Number of Cooperative Health Centres		48	75
Number of medical examinations		36,180	76,975

In 1936 the Cooperatives employed 85 physicians or more than one for every 1000 members. The number of peasants who are members of Cooperatives is not large, and the groups are small, too small to be self-supporting.

[14] About Cooperatives see: B. Konstantinović, *La Yougoslavie pour la Santé Publique*, *Beograd*, 1937, pp. 46-49.—A. Štampar, *Public Health in Jugoslavia*, London, 1938, pp. 28-30.

Fig. 20.

The Cave of Aesculapius.

Left to right: V. Bologa, V. Gomoiu, L. Thaller, J. Guiart, M. Verhoevens.

Fig. 21.

The Croatian peasant-poet Miškina and Andrija Štampar.

Fig. 22.

Dr. Andrija Štampar.

My general impression is that the idea of Health Cooperatives was good so long as the state services were undeveloped. Today, however, the State Health Centres do a tremendous amount of educational work also. They too mobilize the entire village in the fight against disease and there is probably just as much cooperation between the population of a village and its State Health Centre as in a Cooperative. The peasant has come to recognize that these government agencies are not enemies but friends. And there is no reason why the peasant should be specially taxed. Health is the responsibility of all, and all should contribute, each one according to his ability. If the development of state health services had continued unhampered by economic and political crises there would probably have been little demand for Cooperatives, but when the development was slowed down considerably, Cooperatives offered a promising solution.

Split

On September 14 Dr. Moon, Dr. Temkin and I left Dubrovnik on a Yugoslavian steamer, and toward evening after a beautiful trip along the Dalmatian coast that reminds you so much of Greece, we landed in Split—an astounding city, built into the ruins of the Palace of Diocletian. We went through the Porta Aurea to the place in front of the cathedral which was built into the mausoleum of Diocletian. It was late, we were tired and we sat in a little cafe on the Place, the cathedral in front of us and to our right the gigantic statue of Grgur Ninski, one of Meštrović's most impressive creations. Diocletian had persecuted the Christians, but Christianity had triumphed over him. His mausoleum was gone, replaced by a church, and in front of it stands Ninski who brought Christianity to these shores.

While we sat there the evening papers came with very disturbing news. More incidents had occurred in Czechoslovakia, 17 Czechs had been killed in the Sudeten area, and Chamberlain had decided to call on Hitler in Berchtesgaden. And so we knew that this would be the end of Czechoslovakia and that one more democracy was going to be sacrificed. Personally I never believed in the imminence of war in western Europe because at least two nations are required to fight a war and only one seemed actually willing to take the step.

France had capitulated to England ever since 1936 when under British pressure it closed its frontier to Spain that was being invaded by Germany and Italy. And it was all too apparent that Chamberlain would never go to war with Germany that was playing his game. He would never agree to see a Russian army in Central Europe and it was well known that Russia was the only country that was ready and willing to live up to its treaty obligations. The internal situation of Germany moreover seemed rather precarious. There was no enthusiasm for war of any kind and the downfall of the Hitler regime was certainly not what Chamberlain could wish for.

Not expecting war I decided to go back to Zagreb and to spend a few days with Dr. Štampar (Fig. 22).

Andrija Štampar

I had met him in Moscow in 1936 when he came back from China where he had spent several years in public health work. I met him again in America in the spring of 1938. One morning he came to my office in despair. He told me that he had a most interesting time in the United States but that he was meeting nobody but distinguished professors, that he was sick and tired of them and would like to meet young students. This was easy to arrange and one evening I had a group of students at my home to meet Štampar. He came, a big husky man of 200 pounds, a fighter who is not content with teaching what should be done but wants to do it himself with his own big hands. He sat in an armchair. We crowded around him and asked him to tell us about his work in Yugoslavia. And for several hours he told us a tale that sounded like an epic.

After the World War Yugoslavia was a wreck. Large stretches of land had been devastated and epidemics were ravaging the country. The task of reconstruction seemed desperately difficult. Štampar was appointed Director of Public Health. He was thirty years old, a graduate of the University of Vienna. He began his work in a health department that consisted of a table and a few chairs. But soon he attracted a group of young doctors whom he inspired and filled with enthusiasm for the task. There were no office hours for these young men and women. They worked day and night. Instruments and apparatus were secured, mostly from Germany on repara-

tion account. Increasing funds were appropriated by the government and reconstruction proceeded not along old patterns but following new lines. From the very beginning Štampar was clear in his mind that the protection of the people's health was a primary concern of government and that medical service must be a public service and not a service sold on the open market to whoever can afford to purchase it. He knew that public health is determined by social and economic conditions, and that it is silly to distribute drugs where food is needed. He therefore approached his task in the broadest possible way, helping the people not only to improve their health but their living and working conditions as well. He also knew that prevention is better than cure and that if the battle against disease is to be a victory it must be directed planfully by central organs. In other words, he did in Yugoslavia what Semashko was doing at the same time in the Soviet Union. He built Institutes of Hygiene as directing and coordinating agencies, hospitals, sanatoria, convalescent homes. He built anti-venereal, tuberculosis and malaria stations, school polyclinics and health centres in towns and villages. He was instrumental in bringing through social insurance legislation, and with the young doctors he had trained he carried a vigorous health campaign all over the country into the remotest villages.

Štampar's work went not without opposition, particularly by members of his own profession, doctors of the older generation. He was taking business away from them. He distributed quinine free of charge where they used to sell it. Twice he was almost murdered and politicians were mobilized to oppose him. But as long as the country had a parliament the peasants were backing him. They were the source of his strength. He loved them with every fiber of his heart. He knew that they were the backbone of the country, that they needed health more than anybody else. And they knew that he was one of them. They stuck together, worked together to raise the material and cultural standard of the country. The work succeeded. The people were awakened to become conscious of health. One institution after another was built until 300 of them had been constructed.

And then came the year 1929. Parliament was dissolved, the Constitution scrapped. The peasants lost their voice in government

and Štampar their support. The reactionary forces could now oppose him more strongly and one day he was driven out of office. But his work was so firmly established that it could not be destroyed. His students carried on, and how they venerate him. Wherever I met them, all over the country, they spoke of him lovingly, often with tears in their eyes.

Semashko and Štampar both had the same concept of public health. In the Soviet Union due to the social and economic structure of the country the work can proceed steadily without any interruptions. The totally different conditions of Yugoslavia bruskly interrupted a development that was most promising. Štampar left the country and went to China. His own government did not want him but there were other people in the world, peasants also, who needed his help. He spent three years there travelling all over the country, advising, helping wherever he could, and at the end he wrote several most illuminating reports on the public health situation of various districts with practical suggestions on how to improve it. For a while Štampar worked with the Health Section of the League of Nations in Geneva but he is not an office worker. He was offered a chair of hygiene in his country but he refused it. He is a man of action, not of words.

He lives in Zagreb now with his family. I met him in his study. Mongolian rugs adorn the walls, and there are books wherever you look. He sits there and studies. Health reports from all over the world are sent to him and he keeps track of every health development in every country. He writes. People come and seek his advice. And from time to time he goes to the villages, meets his peasant friends and sees the works that he has created. His time will come again. No country can afford to waste such a dynamic power.

Štampar has summarized his views on public health in the following 9 theses: [15]

> " (1) The education of the people is more important than laws, and for this reason our work (in Yugoslavia) is based upon three small laws only. (2) It is most important to prepare a correct attitude of society towards questions of public health.

[15] *Public Health in Jugoslavia*, London, 1938, p. 9. See also: A. Štampar, *Deset Godina Unapredivanja Narodnog Zdravlja*, Zagreb, 1934.

(3) The question of public health and of the work done for its advancement is not a monopoly of the doctors; but everyone, without distinction, should take part in it. It is only by means of this universal co-operation that public health can improve. (4) A doctor should be mainly a social worker; he cannot go far with individual therapy alone—social therapy provides the means that can lead him to real achievement. (5) A doctor should not be economically dependent on his patients, because such dependence hinders him in the most fundamental of his tasks. (6) In respect of public health no distinction should be made between the rich and the poor. (7) It is necessary to create a health organization in which the doctor shall seek out the patient, and not the patient the doctor, for it is only by so doing that the ever-increasing numbers of those whose health we should protect can be included in our care. (8) A doctor should be a teacher of the people. (9) The question of public health has more of an economic than a humanitarian significance. The chief place for a doctor's work is in the dwellings of the people—the places where men live and work—and not in laboratories or in a doctor's consulting-rooms."

With Štampar I went to visit one of his most important creations, the *School of Public Health in Zagreb*.[16] It was founded in 1927 and built on a Rockefeller grant of 200,000 dollars. It works in close cooperation with the provincial Institute of Hygiene, both being located side by side on top of a hill. Both are very ably directed today by one of Štampar's closest co-workers Dr. Berislav Borčić. The Institute of Hygiene has a department for bacteriology and epidemiology, one for chemistry, and a hospital of infectious diseases. A tuberculosis dispensary and a polyclinic for students of the secondary schools are attached to it. The School of Public Health has a department for field surveys that studies the social, economic and health conditions of various districts and a department for health education that carries on a continuous campaign through lectures, exhibits, movies, posters, and all means of modern health

[16] The Yugoslav Institutes of Hygiene and the School of Public Health, *League of Nations, Bulletin of the Health Organisation*, 1938, Vol. VII, pp. 407-427.

propaganda. A department for sanitary engineering makes plans for water supplies, wells, latrines, and dwellings and maintains a laboratory for water analyses. And finally there is a special department for the preparation of biological products that provides part of the income of the School. In recent years this department began to produce insulin and arsenobenzol preparations that are obviously infinitely cheaper than the imported German preparations.

Like other schools of public health the Zagreb School trains public health officers, school health officers, health visitors, health inspectors, sanitary engineers, and it gives courses in social medicine for the health officers who are preparing themselves to work in social insurance institutions. The School however does infinitely more, and it has a program that I have never seen in any country before. It trains peasants. Peasants from the villages come, men for a course of 5 months, women for 3 months. They are housed in special quarters provided by the school, and during the course they are given instruction not only in public health but in history, geography, economics and agriculture. Back in their villages these peasants become the pioneers of health, the health conscience of the village. They instruct and advise their fellow peasants and are the most valuable co-workers of the health officers. They know the local conditions best and know better than any doctor possibly could where help is needed most urgently. Again this is the correct idea that disease has to be fought not by doctors alone but by the entire population. The School also organizes courses in housekeeping for women in the villages during the autumn and winter months, and during such a course the peasant women are taught the elements of hygiene.

I also visited the *School Polyclinic of Zagreb* which is directed by Dr. Štampar's wife, herself a very able physician and social worker and a fighter in her own field as he is (Fig. 23). The Polyclinic is open to all students of the secondary schools of Zagreb. Teachers have periodic examinations every four years. Treatments are free for all, and the School gives not only medical services but has a kitchen and dining room in which hundreds of needy children receive meals.

I then had the great privilege to travel for two days with Dr. Štampar and Dr. Borčić through Croatian villages (Fig. 24). I was

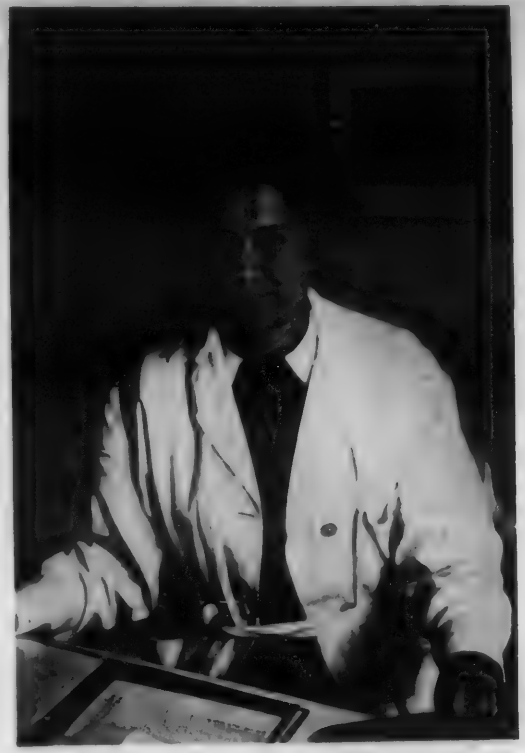

Fig. 23.

MRS. A. ŠTAMPAR

A doctor also and head of the School Polyclinic in Zagreb.

Fig. 24.

Dr. Borčić, a public health nurse, and Dr. Štampar in front of the Health Centre of the Croatian village Mraclin.

Fig. 25.
The Health Centre of Lukovica.

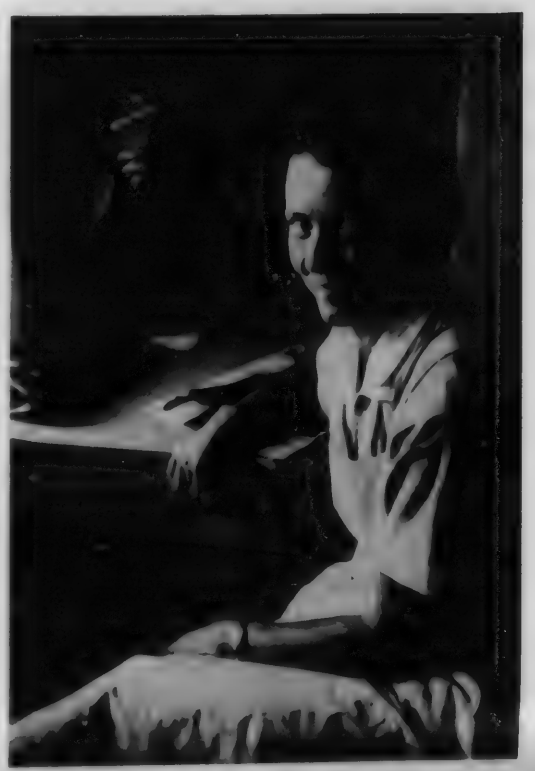

Fig. 26.
The Public Health Nurse of Lukovica.

most anxious to see villages, to meet peasants, and to have a glimpse of the health work achieved in the rural districts. There is a tremendous movement in the Croatian peasantry. They are awakened today and are beginning to reflect about the hardship of their lives. They know that if they want to see conditions improve they must do it themselves, and they know that this requires education. There is a real thirst for knowledge among them and numerous societies have been organized to spread education in the villages. Illiteracy is still high, but there is a plan to overcome it within five years and young people set out with great enthusiasm to teach their elders to read and write. The strong spiritual forces of the Croatian peasantry that for centuries found expression in the beautiful creations of their handicraft have now produced poets, painters, sculptors—simple folk, peasants they too who in their works express the aspirations of their people, their joys and sorrows. I had the great pleasure to meet one of them, the peasant-poet Miškina (Fig. 21). In plain words but most persuasively he told his story. He is a poor peasant, his farm consists of a house and two hectares of land. When the brother of Radić died he felt so overwhelmingly sad that he had to do something about it. He went to the stables to hide and freed his soul by writing on a bit of wrapping paper what he felt. And for three years he wrote in the same way, hidden in the stables. He was ashamed. He felt that what he was doing was not normal, was not what a peasant should do. He was afraid that his wife would laugh at him and scold him. And one evening she found him writing in the stables. To appease her and to justify himself he began to read to her what he had written. For hours they sat in the stables and under the flickering light of a candle he read and she listened, and her eyes were filled with tears. From then on he could write openly in the house, and many of his creations, poems, essays, novels describing the life of the peasant were published under various pseudonyms. Miškina is one of Croatia's great poets today and he is by no means alone.

The village Mraclin that we visited was used as a test ground by the School of Public Health. It has a Health Centre with a public health nurse in attendance. The doctor comes twice a week. Another doctor lives in a community not far from the village and can be

called in cases of emergency. The village is very well equipped with wells, latrines, well-arranged dung heaps and makes a very good impression. I was interested in seeing several orphan children who were in care of peasant families. Such families are very carefully selected by the health authorities. They receive 125 dinars a month and the infant and his surroundings are under the permanent supervision of the health authorities. It is considered an honor for a family to be entrusted with such an orphan child and it gives it much prestige in the village. While we walked through the village we saw a group of young men bowling in one of the gardens. Štampar could not resist. He threw off his coat and bowled with them.

The next day we drove from Zagreb to Ljubljana and visited other Health Centres and public health institutions in Rogatec, Celje, Lukovica (Fig. 25). Everywhere I found a well-equipped Zdrastveni Dom, "Home of Health" as the Health Centres are called. All these Centres give not only examinations and treatments but they are all centres of health education. They all have bath tubs and showers. One that I visited even had an open air swimming pool. And they all have kitchens that provide meals for school children. They are therefore health institutions in the broadest sense of the word. I have a tremendous admiration for the public health nurses that I met in these Centres (Fig. 26). They are well-trained young women who assume great responsibility. As a rule the doctor comes only two or three times a week so that they have to develop much personal initiative. They first of all must gain the confidence of the peasant, and the popularity a Health Centre enjoys depends to a large extent on them. They have the same salaries as school teachers, 800 to 1100 dinars a month and free room and board, but they work harder and have shorter vacations.

We visited the health resort Rogaška Slatina and the tuberculosis sanatorium in Topolsica, an excellent sanatorium of about 300 beds located in a beautiful landscape in the midst of hills and woods. The director of the sanatorium Dr. V. Savić is an excellent surgeon and has very good operative results. The patients stay in the sanatorium for 88 days on an average. Needless to say, the sanatorium is a state institution.

And finally we went to Ljubljana the capital of Slovenia. We

visited the Institute for Mother and Child where not only sick infants but their mothers are admitted as well. The ambulatorium is open to all and I saw a gipsy next to a general's wife. We visited and provincial Institute of Hygiene and the Nurses School and saw the new building of the School Clinic that is just being completed in excellent style. It is Štampar's last creation. The last decree he signed before he left office was the one that appropriated funds for this Clinic.

My Yugoslavian tour, short as it was, was a great and valuable experience. And what impressed me most was to see the creations of Štampar and Meštrović. They are the two men who have made Yugoslavia famous and admired in the world. They do not exploit their fellowmen, but spread health, beauty and happiness. Wherever you travel you find the creations of Meštrović, the buildings, the statues, the monuments with which he has enriched his country. And wherever you travel you find the creations of Štampar, the 300 medical institutions that he has erected to lead his people to a better and happier life. Meštrović has carved the Yugoslavian men and women in stone, their destinies, their sufferings and joys. Štampar has carved the smile in the face of the mother whose child he saved, and has erected for himself a monument in the heart of the Yugoslavian peasantry. Nobody knows what the future of Yugoslavia will be, but I know that the creations of these two men will live forever.

ANNOUNCEMENTS

American Association of the History of Medicine.

The Fifteenth Annual Meeting of the Association will be held at Atlantic City, N. J., on Monday, May 1, 1939. The meeting will begin at 10 A. M. Preceding the afternoon meeting a business session will be held at 2 P. M.

Members who intend to present papers are requested to communicate as soon as possible with the President of the Association, Dr. Walter R. Steiner, 646 Asylum Avenue, Hartford, Connecticut.

A meeting of the Council of the Association will be held on Sunday, April 30, 1939 at 3 P. M. This meeting will be particularly important as it will discuss the future policy of the Association. All Council members are urged to attend it. Members of the Association who are not members of the Council are invited to attend this meeting in an advisory capacity.

Institute of the History of Medicine, Johns Hopkins University, Baltimore, Md.

The result of the *First Graduate Week in Medical History* held at the Institute April 18-23, 1938 was so encouraging (it was attended by 33 members from sixteen states and Canada) that a *Second Graduate Week* will be held in the spring of 1939. The general subject will be *Medicine in the Renaissance*. The full program will be mailed to all members of the Association in January.

The course will take place in the week from April 24 to 29 so that the members will be able to proceed directly to Atlantic City for the Annual Meeting of the Association.

History of Science Society.

The Society held a very successful meeting in association with the American Historical Association in Chicago on December 29 to 30, 1938. The meeting was opened at 10 A. M. in the Hotel Stevens under the chairmanship of Professor Richard H. Shryock and the following papers were read:

Arno B. Luckhardt, University of Chicago
"Dr. William Beaumont and the recently acquired Beaumont memorabilia of the University of Chicago."
K. K. Chen, Lilly Research Laboratories
"Caapi of the South American Indians."
Dana B. Durand, Harvard University
"Science and philosophy in late scholasticism."
George De Santillana, Harvard University
"The emergence of scientific concepts in history—Machiavelli."
George Sarton, Carnegie Institution
"Comenius and Bayle."

At 1 P. M. the members of the Society met for a luncheon at which general matters of the Society were discussed. The afternoon was devoted to a visit to the new Museum of Science and Industry on 57th Street and Lake Michigan, Jackson Park. The Museum is developing very well and promises to be an outstanding institution. The various exhibits were visited and the members heard a lecture with demonstrations on fire prevention which was delivered to the general public by a member of the Museum staff.

At 7 P. M. the members met for a dinner at the Palmer House after which the meeting of the Council was held. Resolutions were passed about the necessity of upholding the freedom of science and the necessity of creating a research institute of the History of Science in this country. The following officers were elected:

Henry E. Sigerist, president
Richard H. Shryock, vice-president
Louis C. Karpinski, vice-president
Henry R. Viets, secretary-treasurer

COUNCIL MEMBERS

F. R. Moulton
H. Fischer
C. L. G. Pratt
Kenneth Franklin
Eric Waller

George Sarton was unanimously elected Honorary President of the Society.

Friday, December 30 the members of the Society met for a morning round table of the American Historical Association. George Sarton was chairman and Professor Lynn White of Stanford University gave a very stimulating lecture on " Technology in the Middle Ages." He stressed the need for more research in the field and the thesis of his lecture was that the chief glory of the later Middle Ages was not its cathedrals or its epic poetry or its scholastic philosophy but rather its building for the first time in history of a complex civilization resting not on the backs of sweating slaves or coolies, but primarily on animal, water and wind power. A long discussion led by Dr. Henry E. Sigerist followed.

At 2.30 P. M. a joint session of the American Historical Association and the History of Science Society was held under the chairmanship of Dr. Chauncey D. Leake on the subject of " History, Science and Society." Papers were read by Frederick Barry, William E. Lingelbach and Henry E. Sigerist. A long discussion followed again and the general impression was that the scientist as well as the historian should have some knowledge of the history of science.

At 7 P. M. a joint dinner of the Middle West Branch of the American Oriental Society and the History of Science Society was held at which George Sarton gave a brilliant address on " Oriental Science."

In a little folder published recently by the Society, its president, Dr. Chauncey D. Leake, has summarized its purpose in the following words:

> " Science is the key to the modern world. Some people think science is running humanity. Others think it is man's only salvation. But as long as there has been any culture or any civilization, science has kept steadily to the same aims, used the same intellectual methods, preserved the same spirit. The analysis of this record and its interpretation for the benefit of our own times, is the purpose of the History of Science Society. This international organization welcomes to membership any thoughtful person interested in the relation of science to the current world."

Members of our Association who are interested not only in the history of medicine but also in the history of science are invited to join the History of Science Society. The annual dues of $5.00 include subscription to the journal of the Society, *ISIS*, edited by George Sarton, undoubtedly the leading periodical in the field.

St. Joseph's College in Collegeville, Indiana, has introduced a course in the History of American Medicine in its pre-medical curriculum. There can be no doubt that such courses are extremely valuable and can contribute a great deal toward a better preparation of the medical student.